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A HANDBOOK OF PRACTICAL
TREATMENT

BY MANY WRITERS

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VOLUME III

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PRACTICAL TREATMENT

CONSTITUTIONAL DISEASES

DIABETES MELLITUS

By Theodore C. Janeway, M.D.

Intelligent treatment of the diabetic presupposes an understanding of the disturbances of body chemistry which constitute diabetes, and exact information as to their degree in each individual case. This information, however, may be obtained by comparatively simple methods, and the main facts of the diabetic disorder of metabolism, which are necessary to an appreciation of the principles upon which treatment is based, I shall review briefly.

Definition.—Diabetes mellitus is a permanent morbid state, characterized by more or less complete impairment of the ability of the organism to utilize energy in the form of the ordinary carbohydrates of the diet. It is, therefore, to be distinguished sharply from transient glycosurias, and from melliturias due to the entrance into the blood of sugars abnormal to the organism,—lactose, for instance, in lactating women,—which are promptly excreted by the kidney, because the normal body has no means for utilizing them.

Differential Diagnosis from Alimentary Glycosuria.—Any person showing transient glycosuria, however, should be subjected to a glucose tolerance test before an opinion as to the nature of his glycosuria is given. This is important for the detection of mild diabetes in the stage when treatment is most efficacious; also in life-insurance examination.* The test is very simple. Two hours after a light breakfast 100 grams (3½ ounces) of glucose are given, dissolved in black coffee or lemonade. The patient is instructed to empty his bladder just before taking the glucose, and to save each subsequent passage of urine for twenty-four hours, taking pains to mark the time of each, and to empty his bladder at the end of six hours. These specimens are examined for sugar. If no glycosuria results, his tolerance may be considered normal. If only a trace of sugar appears during the first six hours, and the urine after this contains no sugar, this may also be taken as alimentary glycosuria. If, however, more than two grams of the glucose is excreted, or the glycosuria persists more than six hours, it is evidence of subnormal tolerance—that is, of latent diabetes.

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* Barringer, T. B., and Roper, J. C.: Amer. Jour. Med. Sci., 1907, cxxxiii, 842.

In infectious disease and in hyperthyroidism the sugar tolerance may be below normal, without of necessity indicating permanent diabetes. Such cases, however, should always be treated as under suspicion until, after recovery, the tolerance has been proved to have returned to the normal.

Glycosuria on a diet containing starch, no matter how abundantly, but no sugar, is best considered prima facie evidence of diabetes. Alimentary glycosuria ex amylo does not come into practical consideration.

Causes.—Of the underlying causes of diabetes, we are still in ignorance. The evidence of experimental diabetes from excision of the pancreas, and the association of pancreatic lesions with many cases of diabetes, makes it probable that failure of an internal secretion of the pancreas is the most important etiologic factor. So far as treatment goes, however, this theory has as yet proved sterile, though Zuelzer has recently reported some suggestive experiments with the intravenous injections of fresh extracts of pancreas.* We have no rational causal therapy of diabetes. More recent theories of the relation of the ductless glands, thyroid, adrenal, and hypophysis, to the pancreas and the sugar metabolism, have also contributed no new standpoint for successful treatment, though there is promise for the future along these lines.† The use of antithyroidin, as urged by Lorand, has had no general commendation.‡

Whether there is a true diabetes of nervous origin is still a debated question. Practically, there is no reason for assuming a nervous diabetes as a distinct type. It is important to remember, however, that the glycolytic function of the liver can be markedly stimulated by occurrences in the central nervous system, Claude Bernard's puncture being the conspicuous example. It is probable also that the pancreatic function is affected by nervous influences acting through the sympathetic system. Accidents, nervous shocks, grief, and worry all exert a most deleterious effect on the carbohydrate tolerance of diabetics, and often transform a mild into a severe form of the disease.

Renal diabetes, in the strict sense, has never been proved. Glycosuria from increased renal permeability is produced by the administration of phloridzin. An essential result is the diminution in the sugar-content of the blood. Until a case of true diabetes has been described, with subnormal blood-sugar percentage, renal diabetes should not be admitted as a clinical entity. Diabetes and chronic nephritis, however, are not infrequently associated. Nephritis may supervene in a diabetic, or vice versâ, or arteriosclerosis may be at the bottom of changes in both pancreas and kidneys.

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* Zuelzer, G.: Zeit. f. exper. Path. u. Therap., Berlin, 1908, v, 307.

† Eppinger, Falta, and Rudinger: Zeit. f. klin. Med., Berlin, 1908, lxvi, 1.

‡ Lorand, A.: "Die rationelle Behandlung der Zuckerkrankheit," second ed., Berlin, 1909, 11.

The Metabolism.—Study of the metabolism in diabetes by clinical methods has yielded results of the utmost practical importance for treatment. As the definition implies, the fundamental disturbance is the inability of the tissues to utilize carbohydrate. The tissues are, therefore, in a state of partial or complete carbohydrate starvation, though they may be bathed in lymph rich in sugar. The sugar circulating in the blood, not being removed by the muscular and other cells for food, therefore accumulates until in excess of the normal upper limit of 1 part in 1000. This excess of glucose in the blood constitutes hyperglycemia. The kidneys, however, have the function of preserving the composition of the blood within normal limits, and promptly remove the excess of sugar, the result being glycosuria, the most prominent symptom of diabetes, and the most ready index of the carbohydrate tolerance of the diabetic. With long-standing hyperglycemia the kidneys lose somewhat of their fine sensitiveness to increase in the blood sugar, and the degree of hyperglycemia tends to rise progressively.

To excrete sugar in the urine increased water is needed, and glycosuria, therefore, leads to polyuria, and the latter to thirst, polydipsia, loss of weight, dryness of the skin, constipation, and many of the clinical symptoms of the disease.

The severity of diabetes is measured primarily by the degree of impairment of the ability of the tissues to utilize sugar. In the milder forms considerable starch may be taken without the appearance of glycosuria. In more severe cases glycosuria persists even after all carbohydrate has been removed from the diet. Experiment has made it evident that this is built up in the organism from the amino-acids of the protein molecule. Even in mild diabetes some of the excreted sugar may have this origin, and in severe cases it assumes great importance. In these cases reduction in the amount of ingested protein may stop the glycosuria. This fact is most significant for treatment, and should never be lost sight of.* As sources of carbohydrate in the organism all proteins are not equivalent. The careful studies of Falta and Gigon † have shown that casein increases the glycosuria in severe diabetes more than any other protein; raw egg-albumen, least of those tested. Von Noorden ‡ ranks casein and meat as the most dangerous to diabetics, egg-albumen and protein of cereals as least so.

In the starving dog diabetic with phloridzin, Stiles and Lusk § have shown that 3.65 grams of dextrose appear in the urine for each gram of nitrogen. As the only source of this dextrose is the dog's own protein, it is clear that nearly 60 per cent. of the protein metabolized is converted into sugar and lost. Mandel and Lusk ‖ described a case of human diabetes with a similar ratio, which they consider evidence of total carbohydrate intolerance. Falta,¶ however, believes that, in human diabetes, 80 per cent. of the protein used may be lost as sugar, giving a D : N ratio of 5 to 1. I am convinced, from personal observation, that the latter ratio is reached by some diabetics, and, therefore, more closely represents total intolerance to all carbohydrate potential in the protein molecule. This ratio we shall use later.

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* For details consult Lusk, Graham: "Science of Nutrition," 2d ed., Phila., 1909, Chap. xii.

† Falta, W., and Gigon, A.: Zeit. f. klin. Med., Berlin, 1907, lxi, 297.

‡ Von Noorden, Carl: "Diabetes Mellitus," New York, 1905, 95.

§ Stiles and Lusk: Amer. Jour. Physiol., 1903, x, 67.

‖ Mandel and Lusk: Deut. Arch. f. klin. Med., 1904, lxxxi, 491.

¶ Falta, W.: Zeit. f. klin. Med., Berlin, 1908, lxv, 463.

Lactic acid, glycerin, and other substances closely allied to the carbohydrates may be converted into sugar and excreted as such in severe human or experimental diabetes, but have not much practical importance.

A few cases have been reported in which patients under careful observation have excreted more sugar than could be accounted for by the preformed carbohydrate and the protein of their food, and these have been held to prove the formation of sugar from fat.* It seems wise to preserve a certain skepticism on this point until complete respiration-calorimeter experiments have put it beyond dispute.

The excretion of sugar in the urine represents a daily loss of energy, which must be replaced from other sources. When large amounts are passed, this is a serious matter. With 250 grams in twenty-four hours, for instance, 1000 calories go to waste. Unless other food, which the organism can utilize, is supplied, the energy deficit will be met by the destruction of the body's own fat and protein, and loss of flesh and strength be rapid. Excessive appetite sometimes automatically meets the needs, but frequently is gratified by carbohydrate foods, and hyperglycemia is increased, with no gain to the body in energy.

The most important secondary results of chronic carbohydrate starvation, however, are seen in the fat metabolism. In mild cases that can be kept free from sugar on diets containing about 60 grams of carbohydrate, the fat combustion goes on normally. In more severe ones, with little or no power to burn sugar, there is a loss of the ability to oxidize the fats normally to carbon dioxid and water. Instead, the process stops at betaoxybutyric acid, $CH_3CH_2OHCH_2COOH_2$, which is in part converted abnormally into diacetic acid, CH_3COCH_2COOH, which again readily changes into acetone, CH_3COCH_3. These three substances are called the acetone bodies. When they are present in the urine, acetonuria is said to exist. Its recognition in diabetes is second in importance only to that of the glycosuria. When only very small amounts are being formed, acetone alone is found in the urine. With any increase, diacetic acid also appears, and, when more than one gram is excreted in a day, betaoxybutyric acid itself appears,† and may be excreted in large amounts—60 grams and more in twenty-four hours.

This abnormal fat metabolism, with its resultant acetonuria, is not peculiar to diabetes, but is the regular sequel of carbohydrate starvation in normal persons. In them it is transient, for the body soon accustoms itself to a protein-fat diet and burns the sugar formed from protein. In severe diabetes, however, not only is there no preformed carbohydrate burned, but much even of the carbohydrate potential in protein escapes the tissues, and consequently carbohydrate starvation reaches an intensity that is without parallel. For this reason the formation of acetone bodies in diabetes surpasses in amount anything known in other conditions.

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* Bernstein, Bolaffio and Westenrijk: Zeit. f. klin. Med., Berlin, 1908, lxvi, 378.

† Von Noorden, Carl: Loc. cit., 91.

The accumulation in the blood and tissues of these organic acids demands their neutralization. This, in turn, leads to loss of alkali by the tissues. The body, tenacious of its fixed alkali, could not long supply the necessary amount day after day were there not another source of potential alkali in reserve. This is the nitrogenous waste, which normally is excreted as urea, but which, when acid accumulates in the body, is utilized for its neutralization in the form of ammonia. Increase of the ammonia of the urine is, therefore, an indication of acid formation in diabetes, and is an approximate measure of its degree. Von Noorden gives the following figures:*

0.5 to 1 gram ammonia in twenty-four hours is normal.
2 grams ammonia = about 6 grams oxybutyric acid.
5 grams ammonia = about 20 grams oxybutyric acid.
8 grams ammonia = about 40 grams oxybutyric acid.

These, of course, are of no significance when alkali is given the patient. With increasing formation of oxybutyric acid there comes in time a train of symptoms which are believed by most observers to be due to acid intoxication or acidosis. Whether these are due to failure of the body's store of actual and potential alkali, to the acid in itself, or to special toxic effects of the betaoxybutyric acid is not clear. These symptoms are lassitude, nausea and digestive disturbance, breathlessness, various nervous manifestations, and eventually coma or collapse. Coma is the sword of Damocles that hangs over the head of every diabetic with severe acidosis. Whatever be our theory of its origin, it is perfectly clear, from clinical experience, that treatment directed toward diminishing the production of the acetone bodies and toward their neutralization is our one hope for the prevention of this dread event. Though the fats are unquestionably the chief sources of these dangerous products, limitation of the fat intake is practically out of the question in severe diabetes, except for a very limited period, for the simple reason that the necessity for limiting carbohydrate and protein is still more imperative, and fat must be the main source of energy. Too little is definitely known about the effect of different fats in increasing acetonuria to have any practical value at present.

The Aims of Treatment.—From the foregoing considerations it is clear that the chief object of treatment is the improvement of the power to utilize carbohydrates, or, as we say, the carbohydrate tolerance. This object is sought directly by all our general measures. It is the avowed object for which drugs are advocated. It is also pursued indirectly by safeguarding the patient from all influences known to diminish his tolerance. Among such influences clinical experience teaches us plainly that hyperglycemia plays one of the chief rôles.

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* Von Noorden: Loc cit., 97.

Failure to institute proper dietetic treatment, or self-indulgence on the part of the patient, so frequently lead to the development of severe diabetes in a previously mild case that it is obvious that overtaxing the weakened power for using carbohydrate is highly dangerous. On the other hand, strict dietetic treatment often leads to an increase in carbohydrate tolerance in mild cases. In addition, the increased sugar-content of blood and tissues seems to diminish the resistance to infection and predispose to various degenerative changes. Many of the complications of diabetes, such as eczema, gangrene, furunculosis, and so on, improve markedly if the urine can be made sugar-free.

The prevention of hyperglycemia, or its limitation, is among the chief aims of all treatment, especially of dietetic treatment, and must never be lost sight of. On the other hand, acidosis and its dangers must be equally kept in mind. In severe cases the need for combating acidosis may be paramount, and the prevention of hyperglycemia become subordinate. Then one is between Scylla and Charybdis.

Finally, no treatment can succeed which neglects the energy requirement of the patient. The maintenance of nutrition is the essential condition of successful dietetic treatment.

To sum up: The treatment of every diabetic seeks to improve his tolerance for carbohydrates, to prevent or minimize hyperglycemia, and to prevent or limit acidosis, while maintaining his nutrition adequately.

The Classification of Cases for Treatment.—The first step in the treatment of a diabetic is the determination of the severity of his disease. The criterion of this is primarily the quantitative carbohydrate tolerance; secondarily, the presence and severity of acidosis. In addition, the general nutrition, the age, and the presence of complications are important.

It is usual to follow the practical classification first laid down by Naunyn,* and consider as mild cases only those patients who can regularly tolerate about 90 grams, or 3 ounces of bread; that is, about 60 grams of starch, when the small amount of carbohydrate of the strict diet is considered. Patients who have glycosuria with this amount of carbohydrate, but who become sugar-free on a strict meat-fat diet, are considered moderately severe cases. Those who still pass sugar on a carbohydrate-free diet are severe cases.

It should be understood that this is merely an arbitrary grouping of the cases for treatment; that it does not represent any such sharp dividing lines in the disease itself; that cases under observation frequently pass from one group to another; and finally that occasional cases show symptoms of a severe type of the disease, with a greater carbohydrate tolerance than this scheme provides. Nevertheless this classification is of real practical value.

The Determination of the Carbohydrate Tolerance.—For the determination of the carbohydrate tolerance in mild cases it is necessary to know the quantity of carbohydrate in the food and of sugar in the

* Naunyn, B.: "Der Diabetes Mellitus," second ed., Vienna, 1906, 382.

urine during a test period. In the more severe cases it is also necessary to take into account the protein intake and the nitrogen of the urine. This is best done by using definite test-diets, as developed especially by von Noorden. While such tests are more easily made in an institution with a proper diet kitchen, it is not very difficult for any intelligent patient to follow a definitely prescribed diet at home. In the severe cases, moreover, successful treatment depends on the accuracy and faithfulness of the patient in every detail, and this might as well be acquired at the start.

In order to simplify the carrying out of the tests and subsequent treatment, I have prepared a series of diet-tables based on the analyses of cooked foods,* as I have found it much easier to trust the weighing of portions to the patients at table than to their household. These tables also are based on the dietetic habits of this country, and differ somewhat from German standards. The weighing is very easily done with a table scale, such as that designed by T. Stuart Hart.† The quantitative tests must all be made in exact twenty-four-hour urine specimens, the twenty-four-hour period beginning and ending before breakfast. The number of grams of sugar excreted in twenty-four hours, the presence of acetone and diacetic acids, and, if the latter is found, the ammonia excretion, are important. Where a good laboratory is at hand, the nitrogen output should be determined in testing a severe case. Proper records, showing urinary findings and diet in parallel columns, are a great aid to intelligent treatment. The technic is as follows: The patient, unless serious digestive disturbance, extreme malnutrition, or threatened coma exist, is put for three days on the standard strict diet shown in Table II, to which are added ten Huntley and Palmer's breakfast biscuit, three at each of the meals, and one with afternoon tea. (Analyses by T. Stuart Hart show an average starch-content of 5 grams per biscuit. Since they can be counted, not weighed, the carbohydrate content of the diet can thus be prescribed most accurately.) Where these are not to be had, 1 ounce (30 grams) of bread may be given at each meal. In either case the carbohydrate of the diet is 60 grams, about 10 grams being contained in the cream and green vegetables, which cannot be dispensed with in the strictest diet. This considerable amount is used because, in patients whose diet has been lax previously, sudden extreme reduction in carbohydrate is not safe. The urine of the third day is examined. If no sugar is found, the patient has a tolerance for at least 60 grams of carbohydrate, and is at once a mild case. If sugar is found, the carbohydrate balance is computed by subtracting its amount from the intake—60 grams. If this balance is negative, that is, the sugar of the urine is more than 60 grams, then, unless the patient has failed to keep to the diet, sugar is being formed from protein, and the case is a severe one. At the same time the reactions for acetone and diacetic acid must be observed, and the ammonia output, if possible. With a negative carbohydrate balance, acetonuria always occurs. Its absence is proof positive that the patient has taken additional carbohydrate.

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* Atwater and Bryant: U. S. Dept. of Agriculture, Bull. No. 28, 1906; and "Nahrungsmitteltabelle zur Aufstellung und Berechnungen für Krankenhaus und Praxis," by Drs. Herman Schall and August Heisler.

† Hart, T. Stuart: Jour. Amer. Med. Assoc., 1909, liii, 457.

To determine the exact tolerance of the patients who become sugar-free on the test diet, additional biscuit or bread is then added every three or more days, until sugar appears in the urine. The tolerance may then be expressed in grams of carbohydrate or in ounces of bread. In such cases further tests of the tolerance for other forms of carbohydrate are advisable before prescribing a diet. This may be done by selecting from Table VIII portions of oatmeal or other desired cereals, potato, and fruits equivalent to the tolerated amount of wheat starch. Extra cream and milk (see Table X) should also be tried. Actual sugar or dishes containing sugar, or beer, with its still more dangerous maltose, must never be attempted.

Most patients after the three days' test will lie between the two extremes; that is, they will excrete some sugar, but not the whole 60 grams ingested. It is impossible to predict definitely whether they will prove mild, moderate, or severe cases until their response to careful treatment has been observed. Their classification and their treatment are so closely intertwined that it is best to group them as intermediate cases, and postpone their consideration until the details of treatment have been taken up.

Methods of Treatment.—The methods of treatment in diabetes comprise the use of scientifically planned diet; of exercise; of other general hygienic and physical measures; and of drugs. Treatment at health resorts or in special institutions has its place in some cases. Special measures are also necessary for certain of the complications of diabetes, and the treatment of coma must have particular consideration. Since each of these means of treatment is differently applicable to particular cases, it is more profitable to consider the treatment from the standpoint of the type of the disease, whether mild, moderate, or severe, than from that of the therapeutic measures. For all cases dietetic treatment is of far greater importance than all other measures combined.

THE TREATMENT OF UNCOMPLICATED DIABETES

Mild Cases.—The management of those diabetics who are found free from sugar on a test-diet containing 60 grams of starch is a comparatively simple problem, and the results are extremely satisfactory. Such patients do not show acetonuria except during periods of strict diet, and every effort should be centered upon keeping them permanently free from glycosuria—that is, permanently without hyperglycemia. Under no circumstances should the physician be satisfied if a mild diabetic has even a fraction of 1 per cent. of sugar in the urine.

Diet.—In every case the treatment should begin with a period of two or more weeks of strict diet. Since there is no need for the restriction of the nitrogen intake in these patients, they may be allowed to select their food in accordance with their appetite from the general diabetic diet-list, Table I, especial care being used to see that they understand all the prohibited foods. It is also important to make sure that they take an ample diet, which they may model on the standard strict diet of the test period, with special attention to the use of a large amount of fat food. Whisky or brandy, light Rhine wine, or claret is important for most patients, to aid in the digestion of the fats. Desserts, such as those in Table XIII, may be taken if the monotony of the diet palls. During this period of strict diet, 10 or 20 grams of sodium bicarbonate should be given each twenty-four hours, dissolved in an effervescent mineral water. This preliminary period of strict diet will often do much to increase the carbohydrate tolerance and to relieve symptoms which may previously have been complained of.

Following this period it is well to determine the tolerance anew. Further treatment will depend upon the age and general character of the patient. Elderly and obese patients may be allowed a diet containing the amount of carbohydrate tolerated, with the interposition of a week of strict diet about once in three months, and with redetermination of the tolerance at least once a year.

In younger patients it is not safe to allow an amount of carbohydrate more than two-thirds of that tolerated, and they must be kept under close supervision; first, because they are more likely to progress from a mild to a severe form of the disease, even under treatment; second, because they are apt to become careless and self-indulgent, and to expose themselves to all kinds of deleterious influences. It is often wise to arrange the diet in periods, as advocated by von Noorden, allowing four to six weeks with one-half of the tolerated carbohydrate, four weeks with two-thirds of the amount, and then two weeks of strict diet, testing the tolerance anew at the end of each strict period.

Hygiene and Exercise.—It is in these mild cases that certain of the other methods of treatment are of particular importance. Exercise, in young individuals with mild diabetes, may markedly increase the amount of carbohydrate burned in the body. Its effect should always be carefully tested, and, when favorable, should be insisted on as regularly as the diet. General hygienic measures are of great importance, especially the prevention of mental or physical overexertion and business or domestic worry. A quiet, well-regulated, and reasonably occupied life is the ideal. When this cannot be obtained at home, then treatment in some health resort fulfils an important function.

Treatment at Health Resorts.—The health resorts most suited for the diabetic are Carlsbad, Neuenahr, and Vichy. The good effect obtained by a stay in one of these, and especially the former, may be attributed to several causes: to the general surroundings and freedom from nervous strain; to regular exercise; to the use of alkaline waters; and chiefly to the intelligent supervision of a physician experienced in the handling of diabetic patients for many years, in hotels where the diet is planned with special reference to their needs. The patient with mild diabetes who will not or cannot regulate his life and diet properly at home should, if possible, be sent to one of these resorts for six weeks every year. Unfortunately, we have no places which combine all these facilities in this country. For most diabetics a hotel is the most dangerous place in the world, because he is constantly tempted to transgress the rules of diet, and because the hotel, even if the diet be strictly adhered to, encourages too great consumption of meat and provides too little of the important fat foods to be safe. However, very mild cases, who can be allowed a considerable amount of starch, may often be wisely sent for a short trip to some warm climate during our long winters.

Drugs.—Certain drugs may also be tried in these cases, as an accessory to dietetic treatment, but never in a more important rôle. The most important of these is salicylic acid, and its derivatives, of which aspirin is perhaps the best. Von Noorden has found that during its use the tolerance of mild cases may be materially increased. It should never be used for more than a few weeks consecutively. One caution is necessary in this connection. Salicylic acid gives rise to a color reaction with ferric chlorid exactly resembling that of diacetic acid, but distinguished by its permanence when the urine is boiled. This should never be mistaken for the diacetic reaction. Rudisch * has recently published results which seem to show a distinct influence of atropin in increasing the carbohydrate tolerance. He recommends using the sulphate in initial doses of $\frac{1}{150}$ grain, three times a day, or the methyl bromid, beginning at $\frac{2}{15}$ grains three times a day. The dose is then increased cautiously up to the production of the earliest toxic symptoms,—dilated pupils, dry throat, and flushed skin,—then stopped for a time and resumed. I have as yet had no personal experience with it, but it deserves a trial in cases where absolute dietetic control will allow certain conclusions as to its effects. The jambul fruit has also been advised, and von Noorden has found its effects somewhat similar to those of salicylates. Again, I have had no personal experience with it. In nervous individuals bromids may often be given with advantage, and sometimes quinin. Arsenic, which is so frequently prescribed for diabetes, I believe is wholly without effect. The opium preparations should not be used in the mild cases. My personal feeling is strong that, except for the relief of special symptoms, drugs may be wholly dispensed with, and that the vitally important diet is much more likely to be observed if the attention is not diverted from it by the use of other supposed curative agencies.

Severe Cases.—The treatment of severe diabetes presents a radically different problem from that of the mild form of the disease. The patients have always lost weight and have some degree of muscular weakness. It is, therefore, of prime importance to avoid further loss of body-substance. The maintenance of nutrition is for them the fundamental consideration. In the second place, they have acidosis, often of an extreme degree, and are in constant danger of the development of coma. This is of so much more immediate danger for them than the hyperglycemia, that treatment directed against the acidosis must take precedence over measures to reduce the glycosuria. On the other hand, any considerable experience in handling these cases teaches, as Naunyn has well said, that one may do them harm by too much as well as by too little treatment, but that there is far more practical danger of doing too little. Each case presents an individual problem, and I can only lay down broad lines along which success is most likely to come. With abundant patience and careful attention to every detail, however, many cases of the severest type of the disease may be kept in a state of fair subjective health for a period of years.

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* Rudisch, J.: Jour. Amer. Med. Assoc., 1909, liii, 1366.

Diet.—Energetic Treatment.—If the patient, when first seen, shows a negative carbohydrate balance, well-marked acidosis, and a moderately increased ammonia output, but no digestive disturbance or extreme lassitude, breathlessness, or evidences of threatened coma, treatment should begin with an energetic attempt to diminish the hyperglycemia as much as possible. This is particularly important, because the surest means of diminishing the acidosis over any considerable period of time is to increase the carbohydrate tolerance, and this we definitely accomplish when we diminish the hyperglycemia. Since these patients manufacture sugar from protein, regulation of the nitrogenous foods assumes equal importance with that of the carbohydrates of the diet. In fact, recent studies have shown clearly that severe diabetics are usually more intolerant of the carbohydrate derived from protein than of that taken preformed. I am confident, from my personal experience, that the regulation of the protein intake is the corner-stone of the successful treatment of these cases. The determination of the nitrogen and ammonia of the urine is necessary to the best handling of such patients, and the careful weighing of all the foods is essential. It is, therefore, difficult or impossible to accomplish much outside of a well-equipped sanatorium or hospital, unless a nurse or attendant who can be trusted is put in charge during the period of energetic treatment. I consider this quite as important as to have a nurse in a case of acute infectious disease.

The first step in the treatment will depend on the patient's previous diet, as judged by the intensity of the glycosuria. Where patients have been careless and are passing more than 100 grams of sugar a day, it is not safe to proceed to a strict diet at once, but the carbohydrate allowance must be reduced gradually over at least a week. Cases with less than 100 grams of sugar, unless the acidosis is extreme and the ammonia more than 4 grams, may be put on a strict diet if carefully watched. In any event, at least 30 grams a day of sodium bicarbonate must be given until the ammonia falls below 2 grams, or until the urine reaches a neutral reaction. No rigorous treatment must be undertaken without this.

Low Nitrogen Diet.—The strict diet on which these patients are put must have a low nitrogen content—not more than 12 grams—and an ample number of calories—that is, 35 for each kilogram of body-weight (16 calories per pound). These two conditions are absolutely essential. Table III gives such a standard low-nitrogen diet suitable for a patient of 70 kilograms (155 pounds). With these patients the loss of energy through the excretion of sugar must be calculated. The value of glucose is 4.1 calories per gram. If 50 grams of sugar are excreted daily on this diet, 200 extra calories must be supplied in fat for a patient of this weight, or a loss of weight is certain to ensue. Alcohol, in the form of whisky, brandy, light white wine, or claret, is indispensable with this diet, both to assist in the taking of large amounts of fat and as a source of additional energy. The maximum should contain not over 40 grams of alcohol a day. As the fuel value of alcohol is seven calories per gram, this will give up to 280 additional calories, and it does not increase the glycosuria. On this diet some patients, after a few days or even several weeks, will become free from sugar. These are not the most severe cases, and are the most hopeful for treatment.

Green Days.—Those who do not become free from sugar in one or two weeks must have a few days of still further reduction of the protein intake. This is accomplished by a diet made up largely of green vegetables, and with low caloric value—that is, semi-starvation. This diet was introduced by von Noorden and is called the green diet (shown in Table IV). One or two such green days are introduced, then following this a low-nitrogen diet is resumed, and, if the patient is not free from glycosuria, two more green days are tried at the end of another week. Very frequently one sees patients, whose glycosuria resisted all previous treatment, become free from sugar after a green day. Once this has been accomplished, it is much easier to keep them sugar-free.

Oatmeal Days.—The most severe cases resist even this extreme reduction of protein, and the elimination of practically all the carbohydrate. The worst of these may show sugar excretion on a strict diet five times that of the nitrogen of the urine. Even these are not immediately hopeless. For them the next and final step in dietetic treatment is the trial of the oatmeal cure, recommended by von Noorden. This consists in the use, for two or three days, of a diet of only oatmeal and butter, to which may be added the whites of five or six eggs if the patient is greatly emaciated. A little sour wine and black coffee are allowed as well. Table V gives the directions for this diet. For some unknown reason certain of the most severe diabetics show a tolerance for oat starch, when given alone in this way, very much greater than for any other carbohydrate. It is a diet low in protein, but high in calories, from the large amount of butter. Von Noorden and Falta* have reported cases which became free from glycosuria on this diet, although they had shown sugar even on green days. This I have never seen. What is more common, however, is to see a marked rise in the carbohydrate balance on such days, which means a better combustion of carbohydrate, and, therefore, of fats, with resulting diminished acidosis. Two or three oatmeal days should be given, preceded and followed by one or two green days, and, in some cases, this may be repeated after an intervening period of one week of strict low-nitrogen diet. On the green day following the oatmeal days the urine may be found sugar-free, and may then remain so for a long period. In any event the acidosis and ammonia excretion are usually materially diminished. A few patients do not show this tolerance for oatmeal, and the attempt should be abandoned if the glycosuria and polyuria are much increased and the acidosis unchanged. The best opinion can be formed if the exact carbohydrate balance is calculated.

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* Falta, W.: Arch. Int. Med., 1909, iii, 159.

Most patients on an oatmeal diet, and some on green days, develop edema, sometimes of considerable degree. The cause is not quite clear, but seems to me associated with the diminished glycosuria and polyuria. Some of the reduction in the glycosuria on this diet may be due to the retention of sugar in the edematous tissues, but the beneficial result of this treatment, which I have seen in rare cases, cannot be explained by this. A rapid gain of weight, however, during this treatment, is practically always due to edema, and should never mislead. It may amount to seven pounds or more in three days, being lost promptly with the subsidence of the edema on the return to a strict diet. It seems to do no harm, and may sometimes be avoided by the use of theobromin-sodium salicylate as a diuretic.

The essence of the oatmeal diet is the combination of a moderate carbohydrate and very low nitrogen intake, with abundant calories in fat. Similar so-called cures have been advocated before, using milk, rice (Dühring), or potatoes (Mossé). None of these have had as well-authenticated results as the oatmeal treatment, used as described. Joslin has told me of the satisfactory trial of bread-and-butter days with a few patients. Where oatmeal fails, these may be resorted to.

Drugs.—If, after the trial of all these dietetic measures, the glycosuria still persists, opium, best as codein, one or two grains a day, in divided doses, may be given a trial. If it does not diminish the glycosuria and raise the carbohydrate balance within a week, it should be abandoned, because it increases the constipation and may affect the appetite. It should never be continued for any long period. I have as yet no personal experience with the atropin treatment of Rudisch, nor do I know of its particular application in severe cases.

Hygiene and Exercise.—Exercise is usually dangerous for patients with severe diabetes, and considerable rest should be enforced. Absolute rest in bed is necessary during energetic treatment of very weak and emaciated patients.

Warm baths and inunctions with sweet almond oil will relieve the annoying dryness of the skin. Constipation, from the excessive water absorption by the bowel and the resultant dryness of the feces, is practically invariable. For this cascara or aloin is best for regular use, and occasional doses of castor oil or calomel may be given. If obstinate, the rectal injection of six ounces of warm sweet oil, which should be retained all night, followed by a saline enema, is the most effective measure. Frequent enemas may be necessary with patients in bed.

Patients with severe diabetes should not be sent to health resorts. Travel in itself is bad for them, because of the danger of accident or infection, and the fatigue which it entails. Health resorts are not apt to be sufficiently individualized for patients of this kind, and, if they are to be sent anywhere, it should be to some sanatorium or hospital where they can have the most careful scientific study and accurate regulation of diet. Severe diabetics require practically constant medical supervision to guard against the many dangers inherent in their condition.

During all this treatment the patient's weight and strength must be watched closely. If the loss of weight is rapid, or continues for more than two weeks, the diet must be relaxed.

Subsequent Treatment.—When a great improvement in the patient's tolerance has been achieved as a result of these measures, or the attempt abandoned as hopeless, the patient must be put on a diet permanently low in nitrogen—not over 12 to 14 grams at the outside, with a moderate allowance of carbohydrate. The aim should be to secure a diet upon which the patient maintains his weight and passes not more than 60 grams of sugar a day in the urine. With some patients this is attained by allowing perhaps 50 grams of carbohydrate and 10 grams of nitrogen; in others, more nitrogen and less carbohydrate. The problem is wholly an individual one. With many patients there is a great advantage in introducing one green day each week, or two days' strict diet, followed by a green day every other week. For those who react favorably to oatmeal, occasional periods of this, with an accompanying green day, should be intercalated. If the nutrition of the patient improves, further energetic treatment should be attempted after a few months. If, however, the weight falls progressively, the acetonuria and ammonia excretion increase, then a larger amount of carbohydrate—up to 100 grams a day—may be necessary, with a green day once a week. This carbohydrate must never be considered a source of real energy, but as an accessory to a diet otherwise adequate. Table VIII gives the carbohydrate content of all the more important foods, from which articles may be chosen up to the amount decided upon. It is well to allow the fruits with lower sugar-content, because, as Naunyn has pointed out, these contain the salts of citric and other acids, which enter the blood as carbonates, thus increasing its alkalinity. The addition of cream is important. The effect of milk must be carefully tested on the individual, because casein increases the glycosuria more than any other protein. In the most severe cases all the proteins act equally. Bread, oatmeal, and potato are the foods usually most desired, and, with fruit and extra cream, should generally be chosen.

The Treatment of Acidosis.—Patients may live for several years with a total carbohydrate intolerance and with extreme acidosis, provided the acids are excreted. The method by which we secure the excretion of the betaoxybutyric acid is the constant administration of sodium bicarbonate, and the duration of life in these patients often depends upon the ability to take the large doses necessary. The aim should be to give enough soda to keep the ammonia always below 3 grams. This may require from 15 to 45 grams a day. More than this latter amount I do not think can be taken steadily. I know of no way to make it palatable. I think it is best taken in doses of 10 to 15 grams, dissolved in effervescent water. Patients must be made to see the vital necessity for it.

Intermediate Cases.—The majority of diabetics, when first studied with the three days' test-diet already described, will show a positive carbohydrate balance, but some glycosuria. They are, therefore, intermediate between the mild and the definitely severe cases, whose management I have already outlined. Their exact classification may be impossible until after weeks of treatment. Some are mild cases who have temporarily lost their tolerance through carelessness; some may have been mild cases now progressing toward the severe type of the disease; and still others may belong permanently between the two categories, that is, be cases of moderate severity.

Energetic Treatment.—Further Classification.—The method of procedure with them is as follows: a strict diet, such as Table II, is ordered, and the urine watched every two or three days, especial attention being paid to the acetonuria and ammonia. Sodium bicarbonate is invariably given during this period—from 10 to 30 grams a day, depending upon the intensity of the ferric chlorid reaction. Enough should be given to prevent the ammonia excretion going above two grams, and, if possible, it should be kept close to one gram. It is much easier to prevent the accumulation of acetone bodies than to get them excreted subsequently. If the urine becomes sugar-free after a few days of strict diet, and the acidosis is at first moderate and then rapidly diminishes, and there is no marked loss of weight, energetic treatment may be persisted in for some time without danger, and will probably result in a marked improvement in the patient's tolerance. Patients who are much emaciated are better treated as cases of severe diabetes until the nutrition has sufficiently improved to make more energetic treatment safe. From two to four weeks of strict diet should be maintained. At their end the tolerance to 30 grams of additional carbohydrate should be tested by adding six of the breakfast biscuit, or two ounces of bread a day, for three days. The urine on the last day should be examined. If free from sugar, four more biscuit or another ounce of bread should be added for another three days. If there is still no glycosuria, the patient has acquired a tolerance for 60 grams of carbohydrate, and may subsequently be treated as a case of mild diabetes.

Patients who do not become sugar-free in a few days of strict diet should be put on a low-nitrogen diet, and, if necessary, one or two green days. If the urine is then free from sugar, the standard strict diet should be resumed and persisted in for two to four weeks, unless increasing acetonuria and ammonia or a steady loss in weight are the signals for its abandonment. If these occur, carbohydrate must be allowed and the management must subsequently be along the lines laid down for cases of severe diabetes. If no reason for breaking off the strict diet arises, the attempt should be made to keep it up four weeks, in cases with considerable acetonuria, one green day being introduced each week. At the end of this period the tolerance should be cautiously tested by adding three breakfast biscuit or one ounce of bread for three days, then doubling the quantity if no sugar appears.

Moderately Severe Cases.—*Diet.*—Cases with a tolerance for less than 60 grams of starch, yet who become sugar-free on a strict diet, belong in the category of moderately severe diabetes. In the future management it is necessary to combine some of the principles employed in the treatment of both mild and severe diabetes. It is impossible to keep them permanently without glycosuria, because they cannot live indefinitely on a diet containing the very small amount of carbohydrate tolerated, without committing indiscretions from sheer disgust with the monotony of the diet, or developing a dangerous acidosis. The aim, however, should be to allow only the carbohydrates which they are proved to tolerate best, the choice being between bread, oatmeal, potato, fruit, or, in rare cases, milk, and in such quantity that they show a minimal glycosuria without loss of weight. Increase of the hyperglycemia must be combated by the introduction of frequent periods of strict diet. How this may best be done depends on the individual case. With business men I have succeeded well by making every Sunday a strict day; with others, one week of strict diet followed by one green day may be ordered in each month. Many different plans will suggest themselves in the progress of a case. At least once in six months an energetic treatment should be attempted. The regulation of the protein intake is of definite importance also. A number of these patients may be allowed a medium nitrogen intake, but the meat consumption should be particularly moderate. Some do better with a low-nitrogen diet, as recommended for severe diabetics.

Treatment of Acidosis.—The control of the acidosis is most important in these cases. Whenever the urine shows any reaction to ferric chlorid, sodium bicarbonate should be taken as regularly as food, and the amount should be regulated from time to time by the ammonia determination. At least 30 grams a day should be taken whenever the ammonia goes over 3 grams. The occurrence of coma may be postponed by this simple form of treatment.

Hygiene and Exercise.—These patients, much more than those with mild diabetes, need to have their general hygiene looked after. If they are in an occupation entailing excessive physical or mental strain, they almost always do badly in spite of other treatment.

Change of occupation may be as imperative for them as is change of climate for tuberculous patients. This cannot be too strongly insisted on by the medical adviser. Other sources of worry and anxiety are less easy to avoid. Women with any but the mildest diabetes should not be allowed to marry, and, if married, should not be allowed to bear children.

Exercise has to be tried out in individual cases, but some exercise is apt to be beneficial. Fatigue is always dangerous, and competitive sports should invariably be forbidden. Exercise is usually most desired by young men, and it should be remembered that in them the disease tends to be progressive and requires more careful management than in older persons.

Treatment at Health Resorts.—Whether a patient of this type shall be sent to Carlsbad or other spa depends principally upon the kind of care he is able and willing to have at home. Should he go, it should be understood clearly that he does not get a cure, and that the treatment must continue uninterruptedly after his return.

Drugs.—Drugs are indicated in these cases along the lines already laid down for the mild and severe forms of the disease. Constipation must be prevented, and the appetite and digestion carefully watched. Bitter tonics are often useful where the appetite flags. Alcohol is important, as with severe cases.

Diabetes in Children.—Diabetes in childhood is usually of the rapidly progressive type, frequently leading to death in a year or less. On the other hand, there are authentic records of children who have recovered completely from diabetes. Even mild diabetes in childhood should be handled from the start more along the lines laid down for severe cases, but, where any considerable tolerance for carbohydrate exists, it should not be exceeded. The dietetic treatment presents a peculiar difficulty, because children ordinarily take a large quantity of carbohydrate food, are fond of sweets, and will not eat things which they do not like. Oatmeal, as a form in which to administer starch, has especial advantages for them, and fruits are useful. Large amounts of cream should also be given, and it is impossible to restrict the milk as much as with adults. Such special diabetic preparations as biscuit made from Barker's gluten flour, casoid and akoll biscuit, and others to be found in Table XII, are peculiarly advantageous for children as a vehicle for butter. Alcohol, of course, can be given only in small quantities. The best forms are light white wine or a little brandy. Coffee and tea are forbidden.

Children with diabetes should be taken out of school at once and shielded from fatigue of every kind. The seashore, where they may play upon the beach without exercising violently, is particularly suitable for them. Long naps should be enforced.

DIABETES ASSOCIATED WITH GROSS PANCREATIC DISEASE

When diabetes accompanies pancreatic stone, or a destructive lesion of the pancreas with failure of the pancreatic juice, indications for special treatment are precise. These patients lose a large amount of fat and much of their protein in the stools, and emaciate very rapidly. Pancreatic extract should be given to them with every meal to replace the absent pancreatic juice. Falta * recommends about 10 grams daily of pankreon, combined with calcium carbonate to increase the alkalinity of the intestinal contents, and reports excellent results. In one case I failed with this, but succeeded with chopped fresh sheep's pancreas given as a salad with each meal. This is the only form of organotherapy in diabetes which has yet had any value.

THE TREATMENT OF COMPLICATIONS

Infections.—Many of the complications of diabetes are best attacked by energetic treatment of the primary disease, since they are dependent for their severity largely upon the hyperglycemia. In this category belong pruritus, inflammations of the mouth and gums and urinary tract, furuncles, carbuncles, and diabetic gangrene.

Prevention of infection is worth more than many attempts to cure. Such seemingly trivial matters as paring corns or manicuring nails, especially on the toes, frequently precipitate the onset of diabetic gangrene. Diabetics should be warned to exercise the most scrupulous care in doing these things for themselves, and to insist on strictly aseptic precautions by chiropodists. All injury and bruising of the tissues should be sedulously avoided.

Tuberculosis usually demands renewed attempts at dietetic control of the glycosuria, rather than relaxation of the diet, with special attention to furnishing large amounts of digestible fats. Of course, the general hygienic and climatic treatment of tuberculosis and the local treatment of other infections must not be neglected.

Infection of the genito-urinary tract, such as pyelitis or cystitis, demands that the urine be made sugar-free, even at the risk of undernutrition.

Acute infectious diseases occurring in diabetics are very serious. Except in mild cases, pneumonia is usually fatal. When the diet must be fluid, one may often minimize the bad effects of excessive milk by using part cream and part milk, with whisky, brandy, or coffee. Albumin-water and meat broths are safe, but of little reliance for the maintenance of nutrition.

Degenerative Processes.—On the other hand, dietetic treatment is not so sure to be an advantage in neuralgias and neuritis occurring in diabetics, and it cannot be expected to have any definite effect upon arteriosclerosis when once established, on angina pectoris, or on myocardial insufficiency. These must be treated just as though diabetes did not exist.

Nephritis.—The combination of chronic nephritis and diabetes is not uncommon in elderly persons. Here a low nitrogen diet is indicated, and energetic treatment should never be continued long. Where a tendency to secondary heart weakness shows itself, moderate restriction of fluid intake is necessary, and, in cases of marked edema, salt should also be limited. Alcohol should be used more cautiously with these patients.

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* Falta, W.: Arch. Int. Med., 1909, iii, 159.

Gastro-intestinal Disorders.—Gastro-intestinal disturbances are of frequent occurrence in severe diabetes, and are of serious moment. They occur most frequently in cases with high acidosis, and may be looked upon as prodromal symptoms of coma. Such patients should be put to bed and either starved for a day, or, if already much emaciated, given one or two oatmeal days or small amounts of milk. Sodium bicarbonate in hot water should be given at frequent intervals, or, if diarrhea exists, calcium carbonate. Brandy or wine should also be given. Opium may be used for the diarrhea, but energetic treatment with purgatives is dangerous.

OPERATIVE INTERFERENCE IN DIABETICS

Surgical operations on diabetic patients entail a twofold danger: that of infection due to the lowered resistance of the tissues, and that of collapse or coma following the anesthetic. Where a condition dangerous to life exists, especially gangrene or a suppurative infection, operation is, of course, imperative. Where the condition is not urgent, however, the glycosuria should be reduced as much as possible by strict dietetic treatment before an operation is done. It is also equally necessary to diminish any existing acidosis and bring the ammonia of the urine as near to one gram a day as possible as a preliminary measure. The means of doing this have already been explained, sodium bicarbonate being the most important. Avoidance of unnecessary bruising of the tissues is of great importance in operating on diabetics.

DIABETES IN PREGNANCY

During pregnancy lactosuria is not uncommon, and may easily lead to an erroneous diagnosis of diabetes. In addition, slight transient glycosuria may also be seen without a trace of intolerance remaining subsequently. Apart from these conditions, however, true diabetes may begin during pregnancy; or the careful examinations then made for the first time may lead to the discovery of a previously latent diabetes; or a woman known to be diabetic may become pregnant. Formerly, this combination of pregnancy and diabetes was supposed to be fraught with danger to the lives of both mother and child, and the artificial termination of pregnancy was frequently advocated. This, however, is unquestionably an unnecessary and unwise procedure. Labor should be artificially induced in diabetic women only for the same reasons as would necessitate it in non-diabetics. Indications for very energetic treatment of the diabetes, however, are strong, and the results seem to be altogether satisfactory. A recent study by Neuman * shows clearly that such patients may do as well as other non-pregnant ones, and that the life neither of mother nor child is seriously compromised.

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* Neuman: Zeit. f. klin. Med., 1909, lxvix, 475.

TREATMENT OF DIABETIC COMA AND COLLAPSE

When a patient with severe diabetes, who has been under intelligent treatment, develops coma as the last event in the slow evolution of his disease, without immediate exciting cause, treatment is likely to be of little avail. Many persons, however, develop diabetic coma, as it were prematurely, as a result of careless treatment or none at all, of intercurrent disease, of accident or nervous shock. In such cases energetic treatment may avert the imminent danger, and subsequent careful handling may prolong life for many months. The success of the treatment depends primarily upon the recognition of the early signs of coma and the prompt use of every remedial measure at the earliest possible moment. When coma actually exists, it is very rare to bring the patient out. Whatever be the complete explanation of true diabetic coma, it is definitely associated with diabetic acidosis, and measures which at present offer any prospect of success in its treatment are measures directed toward diminishing the production of betaoxybutyric acid; toward increasing its elimination chiefly by the kidneys; and which provide for its neutralization.

As soon as the first evidence of air-hunger manifests itself, with marked lassitude and digestive disturbance, the diet, if previously strict, should be relaxed, and a considerable quantity of readily digestible carbohydrate given. Milk should be the basis of the diet at this time. At the same time, absolute rest should be enforced, with warmth to the surface. The urine usually diminishes markedly before the onset of coma, and with this the amount of sugar and of acids excreted also falls. This may be misleading, but it always indicates a dangerous retention and not improvement. It is also very characteristic to have a considerable albuminuria with a quantity of granular casts. This is always a danger-signal. Diuretic measures are therefore indicated. Caffein derivatives and sweet spirits of niter are the best drugs. The administration of large quantities of fluid and the use of rectal irrigations or Murphy's drip may all help. In some cases, however, vomiting and an intolerant rectum may complicate the situation and make these means useless. A saline purge is wise, but excretion must be largely through the kidneys and lungs.

The most vital measure is the introduction of large quantities of alkali to neutralize the acids of the blood and tissues, and to render them more easily excreted. The only sure means of accomplishing this is by intravenous injection, for which a sterile 4 per cent. solution of sodium carbonate should be employed. As much as a liter of this should be introduced, if possible, and, if improvement is not rapid, another liter at the end of six hours. Great care should be taken that the canula does not slip out of the vein and the solution dissect up the tissues of the arm. I have seen a nasty slough formed as a result of this accident. At the same time as much sodium bicarbonate as possible should be given by the mouth and rectum, and its administration should be continued until the urine becomes alkaline. After this has been achieved the danger is passed. Edema may result when these enormous amounts, 100 grams or more, are given, but they are absolutely necessary. Following the injection the effects in some cases are almost magical. Patients become brighter, the respiration slower, and the pulse fuller, and these results are frequently seen during the injection itself. Falta * recommends the administration of levulose, even by hypodermoclysis, in comatose patients, but I should be unwilling to take the risk of sloughing the skin. One hundred grams of levulose may, however, be given by the rectum.

After recovery from impending coma, energetic diet with oatmeal days, as laid down for severe diabetes, should be instituted in all cases that have not been on strict diet previous to the onset of coma. For these latter cases relaxation of the diet for a time is the wiser procedure.

Collapse, which occasionally occurs under the same conditions as true coma, is apt to be equally fatal and less readily treated. The means for combating it are practically the same as for surgical shock: absolute rest with abundant artificial warmth to the surface, intravenous infusion, and cardiac stimulants, perhaps hypodermoclysis. I have not yet had an opportunity to try saline injection with $\frac{1}{100,000}$ adrenalin, but should consider it indicated. Uremic coma or coma due to gross cerebral lesion, occurring in the course of diabetes, should be treated in the same way as when existing alone.

For further details see the text-books of Naunyn and von Noorden, and Magnus-Levy, "Das Koma diabectium und seine Behandlung," Halle, 1909.

RESULTS OF TREATMENT

The most successful treatment of the diabetic cannot offer him the prospect of a cure. Since the disease, however, in the mild forms entails no marked disturbance of the general health, and the treatment demands merely the exercise of self-control and intelligence, prolonged life is more nearly an unmixed good than in most chronic diseases. Much can be done to preserve and enhance the efficiency and well-being of the patient for many years in the majority of cases, provided the treatment is begun early and is firmly adhered to. An early diagnosis is of great moment, and will probably prolong the average life of diabetics many years. Testing the glucose tolerance of all persons showing a transient glycosuria, and of persons with known hereditary tendencies to the disease, should be a most important help toward this. I know few tasks which repay the pains taken in the performance so well as the treatment of diabetes, because, unlike so much of medical treatment, the good results are not due to the natural tendencies of the disease, nor are they the chance accompaniments of our therapeutic measures, but are directly due to our efforts.

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* Falta: Arch. Int. Med., 1909, iii, 159.

DIET TABLES AND THEIR USE

The following diet tables are in large part self-explanatory. They have been prepared with a view to facilitating as much as possible the accurate prescribing of diets with a known content of carbohydrate, nitrogen, and calories suitable for the diabetic. Table I gives a list of all foods in common use in this country,. which are permissible to diabetics, as well as a second list of prohibited articles. At the outset of treatment with any patient he should be provided with some such list as this, and it is the duty of the physician to make sure that he is thoroughly familiar with its contents. His planning of his own meals will be much simpler if the standard diets given in Tables II and III are used during the preliminary test period. During each test period the patient should be required to keep an accurate record of all food eaten.

To prescribe a diet for any given patient, first determine the total number of calories necessary for his or her weight, 35 calories per kilogram (16 per pound) being the standard for persons doing ordinary light work; about 25 per kilogram (12 per pound) for patients in bed. The nitrogen content of the diet must also be determined according to the principles already given in describing the treatment of mild and severe cases. Even patients with mild diabetes should not be allowed to exceed 20 grams of nitrogen a day. From Table VI select such portions of meat, fish, and eggs, as will contain approximately the desired amount of nitrogen, taking also 30 grams (1 ounce) of cheese from Table VII. Foot up the number of calories contained in these portions of nitrogenous foods. A large part of the calories even in these foods comes from their fat content. Subtract the calories thus obtained from the total calories required for the patient; the remainder must then be made up from foods, rich in fat, which are to be found in Table VII, with wine or spirits up to an alcohol content of not over 40 grams a day (see Table XI), green vegetables, salads, meat broths, and other practically non-nitrogenous articles of diet contained in the general diet-list, and may be left to the patient's own taste. With a little practice such a diet may be planned in five to ten minutes.

For the patient who is allowed a certain daily portion of carbohydrate, selection should be made from Tables VIII, IX, and X, and absolute accuracy should be insisted upon in the weighing of these portions until the patient becomes thoroughly familiar with the size of a portion.

There are no satisfactory substitutes for bread. Most of the diabetic foods on the market contain as much carbohydrate as bread, and are really fraudulent. (See A. L. Winton's analyses of diabetic foods, Report of the Connecticut Agricultural Station, 1906, 153.) The few such diabetic breads and biscuit which have a really low carbohydrate content I have given in Table XII. As a rule, it is better to allow the carbohydrate portion as ordinary bread, which the patient enjoys, rather than as a somewhat larger quantity of a wholly unpalatable gluten preparation.

In Table XIII, I have given a few special recipes which have proved helpful to me in giving variety to the diabetic diet. Any ingenious cook can plan many such dishes within the prescribed limitations, and act as a valuable ally to the physician.

TABLE I.—GENERAL DIABETIC DIET-LIST.

May take freely:

Soups: All meat soups and broths. May add vegetables allowed, egg, or cheese.
Meats: All fresh, smoked, and cured meats (except liver), poultry and game, without sauces or gravies containing flour; pâte de foie gras.
Fish: All kinds, except oysters, clams, and scallops, cooked without bread-crumbs or meal; all dried, salted, smoked, or pickled fish.
Eggs: Prepared in any way without flour.
Fats: Butter, lard, suet, olive oil, or other fats.
Cheeses: All kinds, especially cream, Swiss, English, and pineapple cheese.
Vegetables and salads: Asparagus, beet greens, Brussels sprouts, cabbage, cauliflower, celery, chicory, cresses, cucumbers, egg-plant, endive, kohl-rabi, leeks, lettuce, okra, pumpkin, radishes, rhubarb, salsify, sauerkraut, spinach, string-beans, tomatoes, vegetable marrow.
Pickles made from the above vegetables, unsweetened; ripe olives.
Fungi: Mushrooms and truffles.
Cream: Not over 3 ounces a day.
Condiments: Salt, pepper, cayenne, paprika, curry, cinnamon, cloves, English mustard, nutmeg, caraway, capers, vinegar, and the piquant sauces in small quantities, unless specially forbidden.
Desserts: Jellies made from gelatin; custards and ice-cream made with eggs and cream; all sweetened with saccharin, and flavored with vanilla, coffee, or brandy.
Nuts: Butternuts.
Beverages: Tea or coffee, sweetened with saccharin, and with the portion of cream allowed.
Whisky, brandy, rum, and other distilled liquors, up to 3 ounces a day.
Light Rhine or Moselle wine, claret, or Burgundy, up to 16 ounces a day (one pint).
Mineral waters of all kinds.
Lemonade in small quantity, sweetened with saccharin.

ARTICLES PROHIBITED, EXCEPT AS PRESCRIBED IN THE ACCESSORY DIET:

Sugars and sweets of every kind.
Pastry, puddings, preserves, cake, and ice-cream.
Bread and biscuit of all kinds, toast, crackers, and griddle cakes.
Cereals, such as rice, oatmeal, sago, hominy, tapioca, and barley.
Macaroni, potatoes, carrots, parsnips, beans, peas, beets, green corn, and turnips
Fruit of all kinds, fresh or dried.
Soups, sauces, or gravies thickened with flour or meal, or made with milk.
Beer, ale, porter, all sweet wines, sherry or port wine, sparkling wines, cider, and liqueurs.
Milk, chocolate, or cocoa.
All sweet drinks and soda-water.

TABLE II.—STANDARD STRICT DIET.

Breakfast:

2 eggs.
Ham, 90 grams (3 ounces).
Coffee, with 45 grams (1½ ounces) cream.
Butter, 15 grams (½ ounce) on the biscuit during the test period; cooked with the eggs if no biscuit or bread is taken.

Luncheon:

Meat (steak or chops), 120 grams (¼ pound).
Green vegetable from list, 2 tablespoonfuls.
White wine, 2 claret glasses (6 ounces), or—
Whisky, or brandy, 2 tablespoonfuls (1 ounce).
Butter, 15 grams (½ ounce), with the green vegetable if no biscuit or bread is taken.

Afternoon tea with 15 grams (½ ounce) of cream.

TABLE II.—STANDARD STRICT DIET.—(*Continued.*)

Dinner:
Any clear soup.
Fish, 90 grams (3 ounces).
Meat (beef, mutton, turkey, or chicken), 120 grams (¼ pound).
Green vegetable from list, 2 tablespoonfuls.
Salad with 15 grams (½ ounce) of oil in the dressing.
Cream cheese, 30 grams (1 ounce).
White wine, 2 claret glasses (6 ounces) or—
Whisky or brandy, 2 tablespoonfuls (1 ounce).
Demi-tasse of coffee.
Butter, 30 grams (1 ounce) on the fish, meat, and green vegetable, if no bread or biscuit is taken.
Bedtime:
Bouillon, with 1 raw egg.

Nitrogen=18 gram. Total Calories=2550.
Omitting ham, nitrogen=15 grams. Total Calories= 2200

TABLE III.—STANDARD DIET WITH RESTRICTED PROTEIN.

Breakfast:
2 eggs.
Bacon, 15 grams (½ ounce).
Coffee, with 45 grams (1½ ounces) of cream.
Butter, 20 grams (⅔ ounce).
Luncheon:
1 egg.
Bacon, 15 grams (½ ounce).
Meat (lamb-chops, ham or beefsteak), 60 grams (2 ounces).
Salad with 15 grams (½ ounce) of oil in the dressing.
White wine, 2 claret glasses (6 ounces), or—
Whisky or brandy, 2 tablespoonfuls (1 ounce).
Butter, 40 grams (1⅓ ounces).
Afternoon tea with 15 grams (½ ounce) of cream.
Dinner:
Any clear soup.
Meat (roast pork, beef, mutton, turkey, or lamb-chops), 90 grams (3 ounces).
Vegetables from list, 2 tablespoonfuls.
Salad with 15 grams (½ ounce) of oil in the dressing.
Cream cheese, 30 grams (1 ounce).
White wine, 2 claret glasses (6 ounces), or—
Whisky or brandy, 2 tablespoonfuls (1 ounce).
Demi-tasse of coffee.
Butter, 30 grams (1 ounce).
Bedtime:
Bouillon with 1 raw egg.

Nitrogen=10 grams. Total Calories=2500.
Omitting 30 grams of butter and ½ ounce of bacon, calories=2250.

TABLE IV.—GREEN DAYS.

Breakfast:
One egg, boiled or poached.
Cup of black coffee.
Dinner:
Spinach, with a hard-boiled egg.
Bacon, 15 grams (½ ounce).
Salad, with 15 grams (½ ounce) of oil.
White wine, ¼ liter (4 ounces), or whisky or brandy 30 c.c. (1 ounce).
4.30 P. M.:
Cup of beef-tea or chicken broth.
Supper:
1 egg, scrambled, with tomato and a little butter.
Bacon, 15 grams (½ ounce).
Cabbage, cauliflower, sauerkraut, string-beans, or asparagus.
White wine, ¼ liter (4 ounces), or—
Whisky or brandy, 30 c.c. (1 ounce).

Sodium bicarbonate, 15 to 30 grams (½ to 1 ounce) in the twenty-four hours.
Nitrogen=5 grams. Carbohydrate=about 5 grams. Calories=575.

TABLE V.—OATMEAL DAYS.

Porridge made from oatmeal, 250 grams (½ pound), with butter, 250 grams (½ pound); salt and pepper to taste.

Black coffee, light white wine, ½ liter (8 ounces), or cognac, 60 c.c. (2 ounces).

The whites of six eggs may be added to the porridge if desired.

	Nitrogen. Grams.	Carbohydrate. Grams.	Calories.
Oatmeal	6.2	170	1025
Butter	0.4	..	1975
	6.6		3000
Alcohol (40 grams)			210
6 egg whites	3.6		90
	10.2		3300

TABLE VI.—FOODS RICH IN PROTEIN. THE CHIEF SOURCES OF NITROGEN.

	In 100 Grams.		In 1 Ounce.		Approximate Portion to Contain 1 Gram Nitrogen.	
	Nitrogen.	Calories.	Nitrogen.	Calories.	Grams.	Ounces.
Meats:						
Beef, roast, fat	3.4	356	1.0	100	30	1
Beefsteak, tenderloin	3.6	286	1.0	81	28	1
Beefsteak, sirloin	3.7	192	1.1	55	27	1
Lamb, roast	3.0	198	0.9	56	33	1⅛
Lamb-chops, broiled (without bone)	3.3	366	1.0	104	30	1
Mutton, roast	4.0	312	1.2	90	25	⅞
Ham, boiled	3.2	290	1.0	83	31	1
Ham, fried	3.4	400	1.0	114	30	1
Pork steak, broiled	3.0	503	0.9	143	33	1⅛
Capon, roast	4.3	217	1.2	62	23	⅞
Turkey, roast	4.4	285	1.3	81	23	⅞
Chicken, broiled	4.5	145	1.3	40	22	⅞
Plover, roast	3.4	217	1.0	62	30	1
Fish:						
Bluefish, cooked	4.0	147	1.2	42	25	⅞
Mackerel, broiled	3.6	157	1.0	42	25	⅞
Salmon, cooked	4.0	230	1.2	66	25	⅞
Sardines, canned	3.5	277	1.0	80	29	1
Eggs:						
Eggs, Each, nitrogen = 1 gram calories = 75						
Eggs, whites	2.0	44	0.6	13	50	1¾
Each, nitrogen = 0.6 gram calories = 15						
Eggs, yolks	2.5	356	0.7	103	40	1½
Each, nitrogen = 0.4 gram calories = 60						
The Following Contain Carbohydrate:						
Liver, broiled (6 per cent.)	3.5	152	1.0	43	28	1
Clams, round (5 per cent.)	1.5	75	0.4	21	67	2½
Oysters (3.5 per cent.)	1.0	50	0.3	14	104	3⅝
Scallops (3.5 per cent.)	2.2	75	0.6	22	45	1¾

In mild cases 100 grams (3 ounces) of these may be allowed, but they must be excluded from a strict diet.

TABLE VII.—FOODS RICH IN FATS. THE CHIEF SOURCES OF ENERGY.

	In 100 Grams.		In 1 Ounce.		Approximate Portion to Contain 1 Gram Nitrogen.	
	Nitrogen.	Calories.	Nitrogen.	Calories.	Grams.	Ounces.
Practically Pure Fats:						
Vegetable oils	..	930	..	270	..	..
Cod-liver oil	..	920	..	267	..	..
Butter	..	790	..	225	..	..
Oleomargarin	..	790	..	225	..	..
Fat foods whose protein and carbohydrate content may be disregarded in mild cases, and when used in ordinary quantity, for cream, 100 grams (3 ounces), for the other articles not to exceed 60 grams (2 ounces). When used in larger quantity, or in cases requiring restriction of protein, their nitrogen and carbohydrate content must be included in the daily total. Not more than 200 grams (7 ounces) of cream should be used.						
Bacon	1.5	666	0.4	189	66	2½
Pâte de foie gras	2.2	376	0.6	110	45	1¾
Yolk of egg	2.5	356	0.7	103	40	1½
(each = nitrogen 0.4 gram, calories, 60)						
Cream, centrifugal, 40 per cent.	0.5	388	0.15	112	200	7
Cream, gravity, 16 per cent.	0.5	175	0.15	50	200	7
(Carbohydrate = 3.5 per cent).						
Cheeses (carbohydrate content averages 2 per cent.):						
Cream	0.8	568	0.3	161	125	4
Old English	4.8	525	1.4	150	21	¾
Pineapple	4.7	493	1.4	140	22	¾
American	4.6	452	1.3	130	23	⅞
Swiss	5.0	442	1.5	125	20	¾
Roquefort	3.6	374	1.0	106	28	1
Neufchâtel	3.0	336	0.9	96	33	1
Brie	2.6	266	0.75	77	39	1¼

TABLE VIII.—FOODS RICH IN CARBOHYDRATE. THE ACCESSORY DIET.

All foods included in this table are forbidden unless prescribed as accessory diet. For this purpose, if the carbohydrate tolerance has been determined in grams, the daily allowance may easily be calculated from the column giving the carbohydrate content. If the tolerance has been determined in ounces of bread, the column of equivalents on the right should be used. The nitrogen content of all these foods may be disregarded in the quantities used as accessory diet.

	In 100 Grams. Carbohydrate.		Amount Equal to 1 Ounce White Bread.	
	Grams.	Calories.	Ounces.	Calories.
Flours, Cereals, Wheat Products:				
Barley, buckwheat flour, hominy, rice, rye flour	80.00	360	¾	77
Wheat flour, macaroni, spaghetti, vermicelli, noodles, shredded wheat biscuit, farina, cornmeal	75.00	390	⅞	92
Oatmeal (nitrogen = 2.5 per cent.)	67.50	410	⅞	101

TABLE VIII.—FOODS RICH IN CARBOHYDRATE. THE ACCESSORY DIET.—(*Continued.*)

	IN 100 GRAMS. CARBOHYDRATE.		AMOUNT EQUAL TO 1 OUNCE WHITE BREAD.	
	Grams.	Calories.	Ounces.	Calories.
BREADS AND CRACKERS:				
All breads and rolls	55.00	285	1	82
Cornbread	45.00	265	1¼	94
Zwieback	73.00	430	⅞	119
Crackers, average	72.00	430	⅞	119
Huntley and Palmer's breakfast biscuit	57.87	..	1	..
(each = 4.92 grams starch)				
Huntley and Palmer's oaten biscuit	56.16	..	1	..
(each = 11.46 grams starch)				
COOKED CEREALS, ETC.:				
Rice, boiled	25.00	112	2¼	72
Hominy, boiled	18.00	84	3	66
Macaroni, boiled	16.00	90	3½	91
Oatmeal, boiled	12.00	62	5	90
(nitrogen = 0.45 per cent.)				
VEGETABLES:				
Potatoes, boiled	20.00	97	3	69
Potatoes, uncooked	18.00	85	3	84
Artichokes	17.00	80	3	66
Parsnips	14.00	66	4	72
Onions, uncooked	10.00	50	5	70
Onions, boiled	5.00	42	10	120
Carrots	9.00	46	6	78
Squash	9.00	48	6	84
Turnips	8.00	40	7	77

All vegetables lose about 25 per cent. of their nitrogen, carbohydrate, and calories in cooking.

	IN 100 GRAMS. CARBOHYDRATE.		AMOUNT EQUAL TO 1 OUNCE WHITE BREAD.	
	Grams.	Calories.	Ounces.	Calories.
FRUITS:				
Bananas (without skin)	22.00	100	2½	72.5
Plums	20.00	87	2¾	68.7
Cherries	17.00	80	3	66
Huckleberries	17.00	75	3	63
Nectarines	15.00	62	3½	63
Apples	14.00	64	4	72
Apricots	13.00	60	4	68
Currants	13.00	58	4	68
Pears	12.00	64	4	72
Oranges	11.00	52	5	75
Raspberries	10.00	56	5	80
Pineapple	9.00	44	6	72
Cranberries	9.00	46	6	78
Peaches	9.00	40	6	66
Olives, green	8.50	225	6	384
Lemons	8.00	45	7	91
Strawberries	7.00	40	8	88
Watermelon	6.00	30	9	81
Muskmelon	5.00	20	10	60
Grape-fruit	5.00	20	10	60

TABLE IX.—FOODS RICH IN CARBOHYDRATE AND PROTEIN.

May be used as accessory diet to replace a small portion of the bread allowance in mild cases. In cases requiring restriction of protein their nitrogen content must be included in the daily total. A few of the lower carbohydrate-containing nuts may be allowed as a relish.

	In 100 Grams.			Equivalent.	Equivalent Contains:	
	Nitrogen.	Carbohydrate.	Calories.		Nitrogen.	Calories.
Legumes:						
Beans, baked	1.1	17	130	3	1.0	113
Lima-beans, cooked	0.8	17	100	3	0.7	87
Green-peas, cooked	1.0	15	120	3½	1.0	120
Green-peas, canned	0.6	9	55	6	1.0	96
Nuts:						
Chestnuts	1.0	42	248	1¼	0.4	87
Cocoanut, prepared	1.0	31	687	1¾	0.5	341
Peanuts	4.0	24	563	2¼	2.7	360
Almonds	3.2	17	666	3	2.7	570
Pistachios	3.4	16	659	3¼	3.2	608
Pecans, polished	1.8	13	760	4	2.0	864
Filberts	2.5	13	724	4	2.8	824
Walnuts, black	4.4	12	683	4½	5.8	873
Hickory nuts	2.5	11	735	5	3.5	1045
Brazil nuts	2.7	7	718	8	6.5	1632
Pignolias	5.4	7	625	8	13.0	1435

TABLE X.—MILK AND CREAM.

Small quantities of milk or cream, not to exceed 100 grams (3 ounces), may be used in all cases. Larger quantities should never be given without testing the tolerance, both because of the lactose and also the casein, which is readily converted into sugar. The maximum amounts indicated should not be exceeded unless threatened coma or some other complication demands it.

	In 100 Grams.			In 1 Ounce.			Daily Maximum.		Equivalent to 1 Ounce Bread.
	Nitrogen.	Carbohydrate.	Calories.	Nitrogen.	Carbohydrate.	Calories.	Grams.	Ounces.	Ounces.
Whole milk, average	0.5	5.0	72	0.1	1.4	21	300	10	11
Koumiss	0.4	5.4	53	0.1	1.6	16	300	10	10
Condensed milk, unsweetened (evaporated cream)	1.5	11.2	170	0.4	3.2	49	150	5	5
Cream, gravity, 16 per cent.	0.4	3.5	175	0.1	1.0	51	200	7	15
Cream, centrifugal, 40 per cent.	0.4	3.5	400	0.1	1.0	116	200	7	15

TABLE XI.—WINES AND LIQUORS ALLOWED. CARBOHYDRATE LESS THAN 2 PER CENT.

	In 100 Grams.		Approximate Amount to Contain 40 Grams Alcohol, 280 Calories.	
	Alcohol.	Calories.	Cubic Centimeters.	Ounce.
Rhine and Moselle wines, clarets and Burgundy	8–12	60–84	350–500	12–16
Brandy, Bourbon whisky, gin, and rum	50	350	80	2¾
Rye whisky	60	420	66	2¼

TABLE XII.—DIABETIC BREADS AND BISCUIT.

Akoll Biscuit, Huntley and Palmer. Carbohydrate, 2.7 per cent.; nitrogen, 7 per cent. Each biscuit weighs 5.1 grams and contains 0.14 gram carbohydrate and 0.41 gram nitrogen.

Gluten Meal Biscuit, made from Barker's Gluten Food A, to be had of Herman B. Barker, Somerville, Mass.:

To 1 egg add 1 heaping saltspoonful of salt and beat; then add 6 tablespoonfuls of cold water, and beat until quite thick, or until it becomes in quantity from 1 to 1½ pints, and into this beat 1 tablespoonful of thin cream; add 2 heaping tablespoonfuls of dry gluten; stir this into the previous mixture; stir occasionally during one-half hour until of the consistency of thick gruel; bake thirty-five minutes in well-buttered muffin pans in hot oven.

Carbohydrate, not over 4 per cent.; nitrogen, 13 per cent.

Soja-Bean Meal Biscuit, from Soja-bean meal, to be had of Thomas Metcalf Co., Boston, Mass.:

1 cup of cream; 2 eggs; 1 teaspoonful of baking-powder, salt to taste; Soja-bean meal to make a batter not too thick. Make into 8 cakes.

Casoid Biscuit, to be had of Thomas Leeming and Co., New York City.

Carbohydrate, 8 per cent.; nitrogen, 10 per cent.

Pure Gluten Biscuit and Potato Gluten Biscuit, to be had of Battle Creek Sanitarium Food Co.:

Carbohydrate, 10 per cent.; nitrogen, 13 per cent.

No. 1 Protopuff, Health Food Co., New York.

Carbohydrate, 10 per cent.; nitrogen, 12 per cent.

Diabetic Flours with a minimal carbohydrate content, which may be used for thickening sauces and gravies, or in place of meal or bread-crumbs for frying.

Barker's gluten food A.
Casoid flour.
Soja-bean meal.
Roborat (imported by Lelm and Fink, 120 William St., New York City).

TABLE XIII.—SPECIAL RECIPES.

Special Recipes for the Use of Oatmeal.

(May be substituted for a part of the porridge on oatmeal days).

Oatmeal Popovers:

Into the white of 1 egg beaten lightly stir 100 grams of cooked oatmeal. Mix thoroughly. Drop into heated popover pan. Bake twenty minutes. Serve hot with butter.

Oatmeal Griddle Cakes:

Into the beaten white of 1 egg stir 100 grams of cooked oatmeal and 5 grams melted butter. Drop into griddle pan. Turn when the oatmeal is browned on edges. Serve hot with plenty of butter and cinnamon.

TABLE XIII.—SPECIAL RECIPES.—(*Continued.*)

OATMEAL MUFFINS:

To 130 grams (2 half-pint cups) of oatmeal, ground as finely as possible (coffee-grinder), add 1 heaping teaspoonful Royal baking-powder and ½ teaspoonful of salt. Mixwell and add 1⅓ cups of cold water, and at the end melted butter or lard about half the size of an egg (28 grams). Beat well for a minute, put into buttered muffin pans, and bake in a very hot oven.

SAMPLE DESSERTS.

BAKED CUSTARD:

1 egg.
3 tablespoonfuls cream.
5 tablespoonfuls water.
2 or 3 saccharin tablets.
8 drops vanilla essence.

Beat up well. Bake in buttered dish twenty minutes, with a little nutmeg grated on top.

COFFEE ICE-CREAM:

3 tablespoonfuls cream.
3 tablespoonfuls water.
2 tablespoonfuls coffee with 2 or 3 saccharin tablets dissolved in it.
1 egg.

Mix in saucepan and beat gradually until it thickens. Then cool and freeze.

CHEESE SAVORY:

Stir together till very light 4 tablespoonfuls each of melted butter and grated cheese, with 1 tablespoonful of roborat or Barker's Gluten Food A, 2 tablespoonfuls cream, a flavoring of salt and cayenne, and two well-beaten eggs. Pour into ramikins or cases made of oiled paper, bake in a quick oven, and serve immediately.

DIABETES INSIPIDUS

By Thomas B. Futcher, M.B.

For a disease to be intelligently treated it is essential that its etiology should be understood. Although the causes of diabetes insipidus still remain obscure, valuable contributions to our knowledge concerning this disease or syndrome have been made in the last decade.

It is characterized by the passage of large quantities of pale, sugar-free urine, of low specific gravity, over a long period, accompanied usually by an insatiable thirst. In many instances the polyuria is a symptom of some organic disease, just as jaundice is a symptom of various diseases of the liver and bile-passages. Normal individuals eliminate about one-third of the ingested water through the skin and breath. In diabetes insipidus there is an enormous reduction in the amount of sensible and insensible perspiration.

Diagnosis.—Mistakes in diagnosis are not likely in typical cases. The physician must guard against mistaking the polyuria that accompanies chronic interstitial nephritis, amyloid degeneration of the kidneys, and chronic pyelitis. Careful and repeated chemical and microscopic examinations of the urine should prevent any such confusion. The polyurias of hysteria and drug administration, as well as those following the infectious fevers and the elimination of fluids from the body cavities, are obvious in their origin.

Classification.—The disease may be divided clinically into three groups:

1. Those in which there is an organic basis in the central nervous system. Tumors involving the medulla, pons, and cerebellum are those which are most likely to give rise to a persistent polyuria. Fortunately, it is now becoming more generally recognized that syphilis of the central nervous system is the cause in a considerable percentage of cases. It was the etiologic factor in four out of nine cases reported by the writer. The lesion may manifest itself in the form of a gumma in the situations above noted, or more frequently as a basilar syphilitic meningitis, in which severe headaches and a bitemporal hemianopsia frequently occur. It should be mentioned here that Cushing and his associates have recently shown that there is a close relationship between the functional activity of the pituitary gland and the quantity of urine eliminated. In this group the polyuria is believed to be primary.

2. Those in which a functional neurosis coexists. In this form there is no disturbance in the functional activity of the kidneys and polydipsia is the primary symptom.

3. The renal type. This subdivision is added as a result of com-

paratively recent investigations. It includes, undoubtedly, many of the hereditary cases, as well as those which were formerly classified as primary or idiopathic cases, in contradistinction to the secondary or symptomatic cases, in which the polyuria was supposed to be due to some discoverable organic disease. Talljquist and Erich Meyer have shown that in the renal type the kidneys are incapable of secreting a concentrated urine. This loss of power applies chiefly to the salt and urea. They believe that in this form we have to do with a primary polyuria.

Treatment.—Our first duty should be to ascertain the type to which the disease belongs. The cases which give best results from treatment are those in which syphilis of the central nervous system is the cause. A history of syphilis should be carefully inquired into and in all cases a Wassermann blood-test should be performed. The institution of the usual antiluetic measures often causes a marked amelioration of the severe headaches in these cases, together with a striking increase in weight. The writer, however, has failed to see any very material diminution in the thirst or polyuria where a basilar syphilitic meningitis has been the apparent cause.

The researches of Talljquist and Meyer have shown that the dietetic treatment plays a most important part in the so-called renal cases. The diet must be regulated by the functional capacity of the kidney to secrete a concentrated urine. It is, therefore, better to first test the capacity of the kidneys to eliminate salt and urea before attempting to restrict the fluids, for too rapid restriction of the water often causes great distress, and may even do harm, because concentration of the body-fluids would result. The patient should be placed on a diet containing a definite weighed amount of salt and protein. By degrees the amount of salt is diminished and later the protein. Finally the patient may be put on a diet recommended by Talljquist, which consists of 1000 gm. of potato purée, 100 gm. of butter, and 150 gm. of bread, and 500 c.c. of tea. Should the output of urine promptly decrease and its specific gravity increase on such a diet, we can conclude that the case belongs either to the renal type or that it is dependent on organic disease. The physical examination and history of the case will help very materially in determining this point, for in the renal cases there is practically no indication of any organic trouble. The amount of the salt in the diet should never fall below 5 to 6 gm. and that of the protein below 40 gm. daily. There is no occasion for the restriction of the carbohydrates or fat. Occasionally the inability of the kidneys to concentrate the urine is confined only to the salt or the urea. This point should be determined so as to spare the patient unnecessary restriction of diet. The commoner of the salt-free foods are fruit, vegetables, rice, tapioca, sago, fish, fresh meat, eggs, and fresh butter.

Erich Meyer states that theocin increases the functional activity of the renal epithelium, thus enabling the kidneys to secrete a more concentrated urine. The output of urine diminishes and the specific gravity increases. This seems paradoxic, as theocin is one of the best diuretics we possess in cardiac and renal diseases. It should be administered in 5-grain doses, three times daily, after meals, and should always be given a trial.

The cases that are dependent on a functional neurosis are best treated in a hospital, where, in the first place, the neurosis can be best handled. The patients must be educated to drink less. The restriction of the intake of fluid may be fairly rapid at first until the amount reaches 4 to 5 liters daily. As the amount of fluid intake diminishes, the urinary output lessens, and the specific gravity of the urine rises, as there is no lowering of the ability to concentrate urine in this type.

The long list of medicinal remedies that have been recommended is ample evidence of their general inefficiency. Crude opium or the extract, in ½-grain doses, three times daily, gradually increasing until a total of 4 to 6 grains daily are taken, may be tried. The relief, palliative rather than otherwise, is probably due to the lessening of the sense of thirst. Valerian has been much used, and, as is the case with the bromids, chloral, and the belladonna preparations, has given best results in the cases dependent on a functional neurosis. Either the powdered root, given at first in 5-grain doses, three times daily, and increased until the patient takes a total of 2 drams in the twenty-four hours, or the valerianate of zinc up to 30 grains, three times daily, may be given a trial. The preparations of ergot have been highly recommended. Ten minims of the tincture or fluidextract, three times daily, have been reported to be followed by a reduction in the output of urine, but the effect is only temporary.

The therapeutic treatment of this disease has been most unsatisfactory. Considerable alleviation of symptoms may be effected, but the writer has yet to see a single case, even those dependent upon a syphilitic affection of the central nervous system, completely cured. Intelligent treatment along the lines suggested by Talljquist and Meyer in the renal type should give better results than have heretofore been attained.

OBESITY

By Albion Walter Hewlett, M.D.

Nature of the Disease.—By obesity we mean an abnormal and deleterious accumulation of fat in the body. It is difficult, however, to fix the point at which such an accumulation becomes abnormal and deleterious. The height and frame of the individual, his age, and the race to which he belongs influence our standards of weight. The following tables give the accepted averages for individuals in this country and Canada:*

TABLE OF HEIGHT AND WEIGHT AT DIFFERENT AGES FOR MEN

	15–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69
5 ft. 0 in.	120	125	128	131	133	134	134	134	131	
5 ft. 1 in.	122	126	129	131	134	136	136	136	134	
5 ft. 2 in.	124	128	131	133	136	138	138	138	137	
5 ft. 3 in.	127	131	134	136	139	141	141	141	140	140
5 ft. 4 in.	131	135	138	140	143	144	145	145	144	143
5 ft. 5 in.	134	138	141	143	146	147	149	149	148	147
5 ft. 6 in.	138	142	145	147	159	151	153	153	153	151
5 ft. 7 in.	142	147	150	152	155	156	158	158	158	156
5 ft. 8 in.	146	151	154	157	160	161	163	163	163	162
5 ft. 9 in.	150	155	159	162	165	166	167	168	168	168
5 ft. 10 in.	154	159	164	167	170	171	172	173	174	174
5 ft. 11 in.	159	164	169	173	175	177	177	178	180	180
6 ft. 0 in.	165	170	175	179	180	183	182	183	185	185
6 ft. 1 in.	170	177	181	185	186	189	188	189	189	189
6 ft. 2 in.	176	184	188	192	194	196	194	194	192	192
6 ft. 3 in.	181	190	195	200	203	204	201	198		

TABLE OF HEIGHT AND WEIGHT AT DIFFERENT AGES FOR WOMEN

	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64
4 ft. 11 in.	111	113	115	117	119	122	125	128	128	126
5 ft. 0 in.	113	114	117	119	122	125	128	130	131	129
5 ft. 1 in.	115	116	118	121	124	128	131	133	134	132
5 ft. 2 in.	117	118	120	123	127	132	134	137	137	136
5 ft. 3 in.	120	122	124	127	131	135	138	141	141	140
5 ft. 4 in.	123	125	127	130	134	138	142	145	145	144
5 ft. 5 in.	125	128	131	135	139	143	147	149	149	148
5 ft. 6 in.	128	132	135	139	143	146	151	153	153	152
5 ft. 7 in.	132	135	139	143	147	150	154	157	156	155
5 ft. 8 in.	136	140	143	147	151	155	158	161	161	160
5 ft. 9 in.	140	144	147	151	155	159	163	166	166	165
5 ft. 10 in.	144	147	151	155	159	163	167	170	170	169

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* Symonds, B.: "The Mortality of Overweights and Underweights," McClure's Magazine, 1909, xxxii, 319.

Weights within 10 per cent. of these averages may be considered normal; those 20 to 30 per cent. above are moderate overweights; while those more than 30 per cent. above are excessive overweights. Although it has been shown that even moderate overweight affects the average mortality unfavorably, nevertheless we should not be held too closely by such a table. Obesity becomes pathologic when it lessens an individual's efficiency or his ability to resist disease. A given overweight may be carried with ease by one person, while it seriously impairs the activities of another. In some conditions, such as cardiac insufficiency, even the smaller excesses of weight may be disadvantageous.

Causes of Obesity.—If food is taken in excess of the body needs, it is not immediately consumed, but is stored up in the body mainly as fat; and, conversely, an accumulation of fat always indicates that the energy taken in the food has exceeded the energy expended in the form of work, heat, etc. The energy contained in food is measured in terms of the heat produced during its combustion, the unit being the calorie. For example, one gram of fat liberates approximately 9.3 calories in burning; one gram of proteid, 4.1 calories; and one gram of carbohydrate, 4.1 calories; and it makes little difference, so far as fat accumulations are concerned, in which form the additional calories are supplied. Muscular activity is the most important physiologic factor, causing variations in the energy requirements of a given individual. Its effect is shown in the following table:

CALORIC NEEDS OF HEALTHY ADULTS

Resting in bed	30 to 34 calories per kilo of body-weight.
Quiet, out of bed	35 to 40 calories per kilo of body-weight.
Moderate work	40 to 45 calories per kilo of body-weight.
Hard work	45 to 60 calories per kilo of body-weight.

The energy required also depends upon the area of body surface, and for this reason a lean person needs relatively more energy per unit of weight and a fat person relatively less per unit of weight.

From these considerations it will be seen that an individual may gain weight either by taking an excessive amount of energy in his food or by reducing his exercise, or by combining both factors. The amount of exercise taken is difficult to estimate, for it involves not only the external work performed, but the muscular effort put into this work. Compare the placid person who makes no unnecessary movement and relaxes at every opportunity with the nervous person who is restless and often uselessly active, and even in sitting does not relax his muscles. The latter's expenditure of energy is certainly far greater than the former's, and experience seems to show that this difference of temperament is an important cause of leanness or obesity.

Ordinarily, a person is guided in his choice of food by his appetite, and it is remarkable how accurately this leads him to select a diet which will maintain his weight under varying circumstances. In those who tend to obesity, however, this guide is not trustworthy, and many become fat from the regular ingestion of excessive quantities of food. Even a small excess taken regularly will in time produce marked gains of weight. For example, von Noorden calculates that the daily intake of 200 calories, contained in one-third of a quart of milk, over and above the necessary diet, will at the end of a year lead to a gain of 24 pounds of weight.

The question whether or not a person may become fat owing to a constitutionally slow rate of metabolism is still under discussion. The obesity that runs in families or that following castration may possibly be due to an abnormal appetite or lessened bodily and mental activity. In myxedema, however, there is a definitely lessened rate of metabolism, and von Noorden has suggested that a certain number of obese persons owe their condition to a lessened activity of the thyroid gland. The practical bearing of this hypothesis will be discussed under the thyroid treatment of obesity.

Course of the Disease.—The outlook for a spontaneous cure of obesity is not good. As obesity increases the avoidance of exercise becomes more and more necessary, on account of the increasing tendency to sweating and the shortness of breath on exertion. A vicious circle is thus established, for the increasing weight limits the exercise, and the limited exercise tends to increase the weight. With the possible exceptions of those who are approaching old age and those at the time of puberty, the fat person tends to grow fatter as he grows older.

Prophylaxis.—To check a beginning obesity is relatively easy; but to reduce an extremely stout person to even approximately normal standards is often difficult and may be inadvisable. For this reason prophylaxis is very important. It should be undertaken when the weight creeps up year by year, especially in the fourth and fifth decades, or when a family tendency to obesity early manifests itself, or when some other condition, such as cardiac insufficiency, partial paralysis, or chronic joint disease, renders a threatened obesity particularly dangerous. Prophylactic measures are of the same general character as those adopted in the milder forms of the disease, and will be considered below.

TREATMENT

General Plan of Treatment.—The general principles underlying any reduction treatment are evident from what has been said. We may limit the amount of energy ingested in the food, or we may increase the expenditure of energy by exercises, baths, or the use of thyroid substance. Most commonly both methods are adopted, suiting the measures to the patient's mode of life. In some instances the patient is strong and takes sufficient exercise, but he shows an inordinate fondness for the pleasures of the table and indulges especially in sweets and fatty foods. In such a case restriction of fats and sweets may effect a reduction or prevent further gains. On the other hand, the patient may be indolent, taking little or no exercise, and spending many hours in bed. If his heart is in good condition, vigorous exercises and a moderate restriction of diet may be prescribed. Such general directions as these are often sufficient when we are dealing with intelligent persons only slightly overweight, and without serious complications. They may merely prevent further gains, or they may cause a slow reduction of from two to five pounds a month. They can usually be carried out without difficulty and without danger, provided the losses do not exceed those given.

In more resistant cases of obesity, however, or when a more rapid reduction is desirable, a strict régime must be enforced, and this should be done under careful medical supervision. In such cases sanatorium treatment offers the best prospect of success, for here the diet and exercise can be carefully regulated, and the effects of the reduction watched. It must be remembered that the chief aim is a gain in efficiency, and that a mere loss of weight without this is valueless and may be harmful when it induces such symptoms as nervousness, general weakness, or a break in cardiac compensation. A loss of body proteids during reduction treatment is particularly unfavorable. Judicious amounts of exercise tend to prevent this proteid loss and strengthen a heart that may have become weak from inactivity. Rapid reductions of weight should not be undertaken unless some exercise can be given.

The rate at which the weight is lost is also very important. It is generally conceded that a slow reduction extending over a long period of time is much better than a very energetic reduction. Reductions of five to eight pounds in the first month and three to five pounds on succeeding months are without danger, and are apt to be lasting. A rapid reduction, on the other hand, is often accompanied by unpleasant symptoms, and only too often the patient hastens back to his old life and regains his weight as rapidly as possible. By the combination of a strict diet with vigorous exercises, baths, the use of mineral waters, etc., it is possible to reduce some patients from 20 to 30 pounds in a month without deleterious effects. Such methods, however, are only applicable to robust individuals, and are best carried out in sanatoria.

Diet.—Much has been written about the kind of diet best suited for reduction treatment, and many diets have found acceptance from time to time. The principles underlying such diets are now generally agreed upon. The most important feature, and that which mainly governs the rapidity of reduction, is the energy content of the food. All reduction diets are more or less starvation diets, in the sense that they contain a smaller number of calories than are necessary to maintain the weight of the individual receiving treatment. The diet should not be deficient in proteids, for a proteid loss from the body is serious. Finally, the diet should be as satisfying to the appetite as possible. Since the effectiveness and dangers of a diet depend so very largely upon its caloric content, the physician should have some idea of the number of calories contained in the diet that he prescribes. The following table gives the composition and energy contents of some of the commoner foods.

THE CHEMICAL COMPOSITION OF AMERICAN FOOD MATERIALS

These figures are extracted from Bulletin No. 28 (revised edition) of the U. S. Department of Agriculture, Office of Experimental Stations, "The Chemical Composition of American Food Materials," by Atwater and Bryant. For the most part they represent average analyses of edible portions of food.

	WATER	PROTEIN	FATS	CARBOHYDRATES	FUEL, VALUE PER POUND
ANIMAL FOOD:					
Meat:	Per cent.	Per cent.	Per cent.	Per cent.	Calories.
Beef, loin	61.3	19.0	19.1	0.0	1155
" ribs	57.0	17.8	24.6	0.0	1370
" round	67.8	20.9	10.6	0.0	835
" rump	57.9	18.7	23.1	0.0	1325
Roast-beef, cooked	48.2	22.3	28.6	0.0	1620
Round steak, cooked (fat removed)	63.0	27.6	7.7	0.0	840
Tenderloin steak	54.8	23.5	20.4	0.0	1300
Veal, leg,	71.7	20.7	6.7	0.0	670
" loin	69.5	19.9	10.0	0.0	790
Lamb, hind leg	58.6	18.6	22.6	0.0	1300
Mutton, hind leg	63.2	18.7	17.5	0.0	1085
" loin	47.8	15.5	36.2	0.0	1815
Roast leg mutton	50.9	25.0	22.6	0.0	1420
Pork, fresh ham, lean	60.0	25.0	14.4	0.0	1075
" medium fat	53.9	15.3	28.9	0.0	1505
" fat	38.7	12.4	50.0	0.0	2345
" loin chops	52.0	16.6	30.1	0.0	1580
Smoked ham, medium fat	40.3	16.3	38.8	0.0	1940
Smoked bacon	18.8	9.9	67.4	0.0	3030
Chicken, broilers	74.8	21.5	2.5	0.0	505
Fowls	63.7	19.3	16.3	0.0	1045
Fish:					
Bass	76.7	20.6	1.7	0.0	455
Mackerel	73.4	18.7	7.1	0.0	645
Salmon	64.6	22.0	12.8	0.0	950
Shad	70.6	18.8	9.5	0.0	750
Shellfish:					
Lobster	79.2	16.4	1.8	0.0	390
Oysters	86.9	6.2	1.2	3.7	235
Eggs:					
Eggs, hen's	73.7	13.4	10.5	0.0	720
" Boiled whites	86.2	12.3	0.2	0.0	250
" Boiled yolks	49.5	15.7	33.3	0.0	1705
Dairy Products:					
Milk, skimmed	90.5	3.4	0.3	5.1	170
" whole	87.0	3.3	4.0	5.0	325
Buttermilk	91.0	3.0	0.5	4.8	165
Whey	93.0	1.0	0.3	5.0	125
Cream	74.0	2.5	18.5	4.5	910
Butter	11.0	1.0		85.0	3605
Cheese, full cream	34.2	25.0	33.7	2.4	1950
" skimmed milk	45.7	31.5	16.4	2.2	1320

	WATER	PROTEIN	FATS	CARBOHYDRATES	FUEL, VALUE PER POUND
VEGETABLE FOOD:					
Flours and Meals:	Per cent.	Per cent.	Per cent.	Per cent.	Calories
Corn-meal	12.5	9.2	1.9	75.4	1655
Rolled oats	7.7	16.7	7.3	66.2	1850
Rice	12.3	8.0	0.3	79.0	1630
Wheat flour	12.0	11.4	1.0	75.1	1650
" breakfast foods	9.6	12.1	1.8	75.2	1700
Bread and Pastry:					
Bread, white	35.3	9.2	1.3	53.1	1215
" rye	35.7	9.0	0.6	53.2	1180
" Graham	35.7	8.9	1.8	52.1	1210
Rolls	29.2	8.9	4.1	56.7	1395
Crackers	6.8	10.7	8.8	71.9	1905
Cakes, except fruit	19.9	6.3	9.0	63.3	1675
Cookies	8.1	7.0	9.7	73.7	1910
Sugars:					
Sugar, granulated	0.0	0.0	0.0	100.0	1860
" brown	0.0	0.0	0.0	95.0	1765
Honey	18.2	0.4	0.0	81.2	1520
Molasses	25.1	2.4		69.3	1290
Vegetables:					
Beans, dried	12.6	22.5	1.8	59.6	1605
" string, fresh	89.2	2.3	0.3	7.4	195
Beets, fresh	87.5	1.6	0.1	9.7	215
Cabbage	91.5	1.6	0.3	5.6	145
Carrots	88.2	1.1	0.4	9.3	210
Corn, green	75.4	3.1	1.1	19.7	470
Lettuce	94.7	1.2	0.3	2.9	90
Onions	87.6	1.6	0.3	9.9	225
Peas, dried	9.5	24.6	1.0	62.0	1655
" green	74.6	7.0	0.5	16.9	465
Potatoes	78.3	2.2	0.1	18.4	385
" sweet	69.0	1.8	0.7	27.4	570
Spinach	92.3	2.1	0.3	3.2	110
Squash	88.3	1.4	0.5	9.0	215
Tomatoes	94.3	0.9	0.4	3.9	105
Turnips	89.6	1.3	0.2	8.1	185
Fruits:					
Apples	84.6	0.4	0.5	14.2	290
Bananas	75.3	1.3	0.6	22.0	460
Cherries	80.9	1.0	0.8	16.7	365
Oranges	86.9	0.8	0.2	11.6	240
Pears	84.4	0.6	0.5	14.1	295
Prunes	79.6	0.9	0.0	18.9	370
Strawberries	90.4	1.0	0.6	7.4	180
Almonds	2.7	21.0	54.9	17.3	3030
Chestnuts	45.0	6.2	5.4	42.1	1125
Peanuts	9.2	25.8	38.6	24.4	2560
Walnuts, soft shell	2.5	16.6	63.4	16.1	3285
Miscellaneous:					
Chocolate	5.9	12.9	48.7	30.3	2860
Cocoa	4.6	21.6	28.9	37.7	2320

The approximate number of calories necessary to maintain a given individual may be calculated from the data already given. Under the ordinary conditions of life about 35 calories per kilo of body-weight (16 calories per pound) are required. In making the calculation for very fat persons, however, the abnormal fat should be disregarded, and it is more nearly correct to take the height, and from the table of normal heights and weights (page 50) to select the corresponding weight as a basis of calculation. For example, if a man forty years old were 5 feet 8 inches high and weighed 200 pounds, his caloric requirements would be calculated upon the basis of what a man of his age and height should weigh—namely, 160 pounds. Upon this basis his requirement would be 2560 calories instead of the 3200 calories obtained on the basis of 200 pounds of body-weight. A reduction diet should contain from four-fifths to three-fifths, or more rarely two-fifths, of the energy normally required. Patients placed on diets containing less than three-fifths of the necessary amount must be carefully watched for unfavorable symptoms. The amount of proteid contained in the common food-stuffs is shown in the table. Ordinarily, the amount of proteid given during a reduction treatment is quite sufficient, being over 100 grams per day. Under special conditions it has been reduced to 70 grams without deleterious effects, but the giving of minimum amounts of proteids (50 gm. and less) during reduction treatment is inadvisable on account of the added danger of proteid losses. In order to appease the appetite the food should be sufficiently bulky. For this purpose the green vegetables are particularly valuable, and they form an important part of every reduction diet. Potatoes and fruits are also bulky in proportion to their caloric content. On the other hand, fats, starches, and sugars are concentrated forms of nourishment, and are usually to be avoided.

The following reduction diets, which have received popular recognition, will illustrate by what different paths the same result can be accomplished. It is important to bear in mind, however, that most of them involve a very considerable reduction of the caloric intake, and that most belong to the class of very low reduction diets, with their attendant dangers.

The Harvey-Banting diet is characterized by the large amount of proteids allowed, the restriction of carbohydrates, and the practical elimination of fats. The following is an example of this diet: Breakfast: Meat, except pork, 4 to 5 ounces; a large cup of tea without milk or sugar; zwieback or toast without butter, 1 ounce. Dinner: Fish (except salmon) or meat (except pork), 5 to 6 ounces; vegetables, bread, 1 ounce; red wine, sherry, or madeira, 2 or 3 glasses (no champagne, port, or beer). Tea: Fruit, 2 or 3 ounces; 1 or 2 pieces of zweiback; a cup of tea without milk or sugar. Supper: Fish or meat as at noon, 3 to 4 ounces; red wine, 1 or 2 glasses. At bedtime 1 or 2 glasses sherry or red wine. This diet furnishes about 1100 calories, exclusive of the energy contained in the alcohol. The use of such considerable quantities of alcohol is irrational and harmful. Objection has also been made to the large quantity of proteids, which is liable to cause gastro-intestinal disturbances, and is contraindicated in gouty patients.

The Ebstein diet allows considerable proteid and a moderate amount of fat, but diminishes the carbohydrates to a minimum.

Fats are given for the purpose of satisfying hunger. Breakfast: 8 ounces of black tea, without milk or sugar; 1½ ounces toast, with much butter. Dinner: Soup, often made with bone-marrow; 4 to 6 ounces meat, roasted or boiled with a fatty sauce, using especially fatty meats, vegetables in small amounts, especially the leguminous vegetables or cabbage, no potatoes, and few beets; 2 or 3 glasses of a light white wine. After the meal a large cup of tea without milk or sugar. Supper: A large cup of tea, without milk or sugar, an egg or a fatty roast, or ham with the fat, smoked or fresh fish with about 1 ounce white bread and plenty of butter; at times a small amount of cheese or some fresh fruit. Such a diet ordinarily furnishes about 1400 calories a day, but if the person likes fatty food, he may easily take larger amounts and fail to lose weight.

Milk diets are often attended with losses of weight, and their use for this purpose has been recommended by Karell, Weir Mitchell, and more recently by Moritz.* Since a quart of whole milk furnishes about 600 calories and skimmed milk about half this amount, it is relatively simple for the physician to regulate the amount of energy taken and relatively easy for the patient to obtain the diet prescribed. Two quarts of milk daily, which furnish about 1200 calories and 70 grams of proteid, would constitute a strict diet for a man of average height. The milk diet may be used for periods of a few weeks only, alternating it with restricted general diets.

The so-called potato diet of Rosenfeld † furnishes a bulky diet which contains small amounts of proteids. This author prefers small but frequent meals, and recommends the following as an example: First breakfast: Tea with saccharin, a roll, and marmelade. Second breakfast: ⅓ ounce cheese with water. Third breakfast: 3 ounces apples with water. Noon meal: Two glasses of water, one or two dishes of fat-free soup containing potatoes or vegetables, meat without fat, potatoes, spinach, cauliflower, salads without oil. In the afternoon: Tea with saccharin and fruit. In the evening: Two eggs with potato-salad, or meat and vegetables as at noon. Rosenfeld claims that his diet can be taken with ease and continued indefinitely, and that it leads to a gradual and permanent loss of weight.

We have already pointed out that any physician may devise a reduction diet provided he understands the general principles involved and has at hand the necessary tables from which to calculate the number of calories required by his patient and the number contained in a given diet. Even though he adopts some standard diet as a guide, he should be able to modify it to suit the special indications of his case or to meet emergencies that may arise. The following diet has been used at the University Hospital, Ann Arbor. It may be made less strict by allowing sugar and butter.

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* Moritz: "Ueber Entfettung durch reine Milchkuren," Münch. med. Woch., 1908, lv, No. 30.

† Rosenfeld: "Für Methodik der Entfettungskuren," Arch. f. Verdauungskr., 1909, xv, 325.

BREAKFAST

Two (2) eggs, poached or boiled, served without butter	about	170 cal.	
Coffee sweetened with saccharin and with 2 drams milk, if desired.			
1 ounce of bread or rolls without butter	"	76 "	
	"		246 cal.

DINNER

Cup of bouillon or small plate of clear soup from which the fat has been skimmed and to which vegetables may be added	about	30 cal.	
4 ounces lean meat without starchy gravy	"	300 "	
4 ounces potatoes baked or boiled without butter	"	100 "	
Salad of lettuce, celery, fresh cucumbers, or tomatoes flavored with lemon- or orange-juice, no oil	"	15 "	
4 ounces of fresh fruit	"	70 "	
	"		515 cal.

AFTERNOON TEA

Tea sweetened with saccharin and tablespoonful of milk	about	10 cal.	
1 ounce of bread or roll without butter	"	76 "	
	"		86 cal.

SUPPER

4 ounces lean meat without starchy gravy	about	300 cal.	
2 ounces potatoes as at noon or four ounces of spinach, cabbage, or cauliflower prepared without butter	"	50 "	
Fresh fruit 4 ounces or same stewed but sweetened with saccharin, black coffee	"	70 "	
	"		420 cal.

Total, about 1267 cal.

Restriction of Fluids.—Largely through the influence of Oertel's writings, the opinion has become current among the laity that a restriction of liquids will lead to a dissolution of fat in the body. From what has been said it is evident that this is improbable on theoretic grounds, and exact observations have proved it to be without scientific foundation. Drink restrictions may, however, be advisable as an aid to the reduction of weight. Many fat persons drink immoderately. This enables them to wash down their food rapidly, it increases their tendency to perspire, and it throws an added burden on the circulatory apparatus. The restriction of fluids in such persons will often cause an immediate loss of several pounds, owing to a relative drying out of the body. As a result of this, and in consequence of the lessened perspiration, the individual feels more comfortable and is better able to take the exercise that is so essential in treatment. Cardiac insufficiency is an important indication for drink restriction, and it was in such cases that Oertel achieved his best results by the methods which will be described later. It is important to remember, however, that the restriction of liquids should not be pushed too far, and that it is rarely advisable to administer less than 1000 c.c. of free liquids a day.

Exercise.—Next to diet the most important factor in the treatment of obesity is the proper regulation of exercise. Work increases the energy requirements of the body, strengthens the heart and body musculature, and tends, more than any other measure, to protect the body from proteid losses during restriction diets. Without it a rapid reduction is inadvisable. On the other hand, the exercise prescribed must be graded according to the strength of the individual. If the latter is strong and vigorous, the exercise may be made heavy, and rowing, bicycling, tennis, and handball prescribed. If the individual already shows muscular weakness, and especially if he suffers from the symptoms of cardiac insufficiency, the exercises should be very carefully graded. Such persons should be limited to walking or even to carefully supervised resistance exercises. Walking is in general the best form of exercise. It brings into play the muscles often used, and can be very accurately graded by changing the rate at which the person walks or by changing the incline up which he must go. Horseback-riding is not of great value as a reducing measure, except as it assists in overcoming constipation.

Hydrotherapy.—Hydrotherapeutic procedures are valuable adjuncts to reduction treatments. In themselves they are effective only to a limited extent in increasing the body metabolism, but they bring about a number of desirable subsidiary effects. The sweating procedures lessen the amount of water in the body and increase somewhat the rate of metabolism. The cold procedures increase the heat losses and invigorate the patient, making it easier for him to take exercise. This is the chief value of hydrotherapy in these patients. The treatment should be given early in the day, and may consist of a sweat in the electric-light cabinet, followed by a rather prolonged cold shower. The patient should be encouraged to obtain a reaction by a vigorous walk on leaving the bath-house. Milder measures may be necessary at first if the patient has difficulty in reacting, and care must be taken if the patient has signs of cardiac insufficiency.

Drugs.—Cathartic waters have enjoyed some reputation as aids in reducing flesh. Naturally they relieve constipation, and by removing gases from the intestines, may reduce the girth. If given in sufficient quantities, they lessen the appetite and make it easier to follow a restricted diet, but violent purgation weakens the patient and may do harm. The successes achieved at various health resorts are due less to the waters themselves than to the careful supervision and strict dietetic régime. Unfortunately, the persons who submit to vigorous treatment at health resorts often relapse into their old habits as soon as they return home.

Thyroid substance undoubtedly exerts a powerful reducing influence on some forms of obesity, through its effect in increasing the rate of metabolism. It is, however, rather uncertain in its action, being far more effective in some patients than in others, and is often efficient for a limited time only. Furthermore, it may cause a loss of proteids from the body, and it has induced such unpleasant symptoms as weakness, nervousness, and palpitation. For these reasons its use has been materially restricted by careful physicians, and the older and safer methods of diet and exercise are now generally preferred for the majority of cases of obesity. In some instances, however, it seems to act well. Von Noorden,* has attempted to separate a form of obesity which he believes is due to thyroid insufficiency, either primary in the thyroid gland or secondary to disease of some other gland of internal secretion, such as the hypophysis or the genitals. Such patients neither eat to excess nor do they exercise less than their fellows, and attempts to reduce them by the ordinary methods cause great weakness. In such patients von Noorden obtained excellent results by thyroid feeding, with no other dietary rules except the prescribing of considerable quantities of proteids. His results and the results of others would justify a careful trial of thyroid substance in cases which resist the ordinary methods of treatment. The official desiccated thyroid gland is given in capsules in doses of 1 to 5 grains three times a day.

Local Deposits of Fat.—The removal of fat from a given part of the body is difficult and uncertain. As a rule, a slow reduction in weight reduces the superfluous fat from the body rather uniformly, and leaves a relatively good figure. A very rapid reduction, on the other hand, may leave the abdomen large, but the face and upper thorax thin and haggard. Local massage is said to be efficacious against local deposits of fat, but effects seem to be very uncertain, and it often fails entirely. The waist measure can usually be reduced by abdominal massage and abdominal exercises combined with attention to any flatulence present. This effect is due in part to the reduction of flatus and in part to the improved posture which results from a strengthening of the abdominal muscles.

Complications.—In pulmonary tuberculosis and diabetes a moderate degree of obesity is advantageous, and reduction treatment should be instituted only when the obesity is excessive and very burdensome. In these conditions rapid reductions are out of place, but slow and cautious reductions may be undertaken if the obesity is excessive. In other conditions, especially cardiac insufficiencies, or in those diseases which interfere with locomotion, such as chronic joint disease or partial paralysis, the indications for a reduction treatment are more urgent than in normal individuals, and even the slighter degrees of obesity should receive consideration.

By far the most important complication of obesity is cardiac insufficiency. In its milder form this is due to the lack of training of the heart, which remains small and weak in proportion to the body weight. Deposits of fat also interfere with the cardiac and respiratory movements. The more serious forms of cardiac insufficiency are secondary to general arteriosclerosis, coronary disease, chronic Bright's disease, or pulmonary emphysema, to which diseases obese persons seem especially subject.

Excessive body-weight always means more work for the heart, and when obese individuals begin to show signs of cardiac insufficiency, a gradual reduction may do much good. When compensation is already badly broken, and when the patient can take little or no exercise, it is generally too late to institute a reduction treatment. Indeed, such patients commonly eat very little on account of lack of appetite, and they may unwittingly reduce themselves even more rapidly than is advisable. It is in the mild forms of cardiac insufficiency that the Oertel treatment is particularly successful. The three essential factors in this treatment are a moderate reduction diet, a restriction of liquids, and graded exercises. The following illustrates the sort of diet prescribed by Oertel:

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* Von Noorden: "Ueber die verschiedenen Formen der Fettsucht," Med. klin., 1909, v, 1.

Breakfast: 1½ ounces bread; 4 ounces coffee, with ⅔ ounce milk, and ⅓ ounce sugar.

Dinner: 5 ounces soup, 6 ounces beef, 3 ounces vegetables, salad, 3 ounces pudding, 1½ ounces bread, 4 ounces light wine.

Tea: 4 ounces tea or coffee with ⅔ ounce milk and ⅓ ounce sugar.

Supper: a soft egg, 5 ounces roast meat, salad, 1½ ounces bread, 8 ounces of light wine or water.

About 1700 calories are allowed per day. Liquids are reduced to one-half to one quart of free liquid daily. The use of graded exercises requires great care in any form of heart disease. Oertel had his patients walk slowly on the level or up slight inclines, taking a deep inspiration with each step. This treatment is particularly applicable to those whose shortness of breath is due to lack of training of the heart, owing to indolence. When the insufficiency is more severe, supervised gymnastic exercises or carbon dioxid baths with resistance exercises are preferable. In still more severe forms of cardiac insufficiency exercises and reduction diets are out of place, and the cardiac condition must be treated in the customary manner, by rest in bed, digitalis, and diuretics.

The so-called anemic form of obesity, in which the patient is pale and weak, appears to cover several different conditions. In some of these patients the pallor is due to a poor peripheral circulation, associated with slight edema, and these should be treated on the general lines indicated above for heart cases. Others may have some slight myxedema, and are particularly favorable for the administration of thyroid substance. Where the blood shows a true anemia, iron and arsenic may be given.

INANITION

By Albion Walter Hewlett, M.D.

NATURE AND ETIOLOGY

Inanition is the state of exhaustion which results from insufficient nourishment of the body. This may be acute, as in complete starvation and after acute infectious diseases, or it may be chronic. The acute forms are rarely difficult to treat, for with the return of appetite and with sufficient digestible food the body is usually restored to nutritive equilibrium within a relatively short time. Chronic inanition, however, presents more serious therapeutic difficulties, for the etiologic factors are of a more permanent character. In general it is caused either by an increased consumption of body material or by a lessened supply of food to the tissues, or by a combination of both factors. A lessened supply of food may result from poverty, poor appetite, or the fear of pain after meals. On the other hand, the digestive apparatus may be unable to utilize the food taken. This happens especially in stenoses of the esophagus, pylorus, or intestines, and in those conditions where considerable quantities of food pass through the intestines unabsorbed, as is the case in some pancreatic diseases and a few intestinal disorders. An increased consumption of body material is seen in severe cases of exophthalmic goiter, and to a lesser extent in persons who are nervous and active. Infectious diseases nearly always diminish the appetite and often increase the rate of metabolism, and chronic infections, notably tuberculosis, are among the most important causes of chronic malnutrition. The emaciation in the severer forms of diabetes mellitus is due mainly to the loss of sugar in the urine, which deprives the body of just that much nourishment. It is evident that the treatment of inanition will vary greatly according to its etiology. It is not our purpose to discuss the treatment of these various causes, but rather to consider certain general principles of treatment which apply with more or less force to all forms of malnutrition.

The commoner symptoms of inanition are weakness and rapid exhaustion on mental and bodily exertion. In some patients an increased nervous irritability is a very trying manifestation. The pulse is often small and rapid, and a rapid loss of abdominal fat is said to favor the tendency to loose kidneys. These symptoms furnish the main indications for treatment, and persons who are decidedly underweight and suffer from such symptoms are often greatly benefited by gains in weight up to or beyond the normal. (See table, on p. 50.) The methods used to accomplish such gains in weight are the reverse of those used in the treatment of obesity. They consist in increasing the patient's intake and diminishing his output of energy. The former is accomplished by a suitable diet, the latter mainly by mental and bodily rest.

TREATMENT

Diet.—The diet should furnish the patient with amounts of energy in excess of his immediate needs. We have already discussed (p. 51) the energy requirements of normal individuals and the energy content of various food materials. In the case of inanition the endeavor must be made to furnish a larger amount of energy in the food than the body requires to maintain nutritional equilibrium, and this must be done without overtaxing the digestive capacity or the appetite. In any case a preliminary examination of the digestive apparatus is important, for the discovery of secretory or motor changes in the stomach or of abnormal constituents in the feces may point the way toward particular articles of diet or toward medicines which will make it easier for the patient to handle the excessive quantities of food offered to him.

Aside from such special indications the diet chosen should be as digestible as possible, should carry a large amount of energy. and should be easily taken. Milk is usually the most important single article in such a diet, and the success or failure of the treatment may depend to a large extent upon the ability of the patient to take this food. The repugnance which some persons feel for milk should, therefore, be combated by every possible means, for it is exceptional to find a patient who really cannot tolerate it. In order to meet special conditions or to vary the diet, it may be given hot or cold, it may be modified with lime-water, cereal waters, or carbonated waters, or it may be replaced in whole or in part by skimmed milk, buttermilk, or koumiss. Probably the best method of giving milk to those whose appetite is already poor is that recommended by Weir Mitchell. It is made the sole article of diet at the beginning of the treatment, and after the patient has become accustomed to taking large quantities, other articles are added. Milk alone is insufficient for the body needs unless taken in considerable quantities (three quarts yield only about 1800 calories), and for this reason patients often lose some weight when a strict milk diet is instituted. When other foods are added, however, and the milk is taken as a drink at the end of meals, between meals, and before going to bed, it becomes a highly important adjunct, and as such has attained its high position among the foods used in the treatment of malnutrition. According to von Noorden, the energy contained in one quart of milk (600 calories), if taken regularly every day in addition to the maintenance diet, will lead to a gain of one and a half pounds a week.

Of other articles of diet, those consisting largely of starch are especially valuable, because they are high in caloric value and because they can usually be given in large quantities without causing digestive disturbances. Soups may be rendered more nutritious by the addition of rice, pearl barley, and the Italian pastes, and sauces may be thickened with flour. Breads, biscuits, and other articles made of flour should be taken whenever possible, both with meals and with the milk between meals, and the fact that they may be made carriers of butter adds greatly to their fattening value. Such desserts as rice, tapioca, and sago puddings are also especially valuable. Sugar is as nutritious as starch, but it is more liable to cause digestive disturbances, and for this reason it cannot be forced to the same extent.

Fat yields the largest number of calories per unit of weight of all foods, but its use is somewhat limited by the fact that it often cannot be taken in large quantities without causing repugnance or actual indigestion. The fats most easily assimilated are those with high melting-points, especially in the form of natural emulsions. Cream and the yolks of eggs meet these conditions in an ideal manner, and are very important articles of diet in treating inanition. Milk should always be given as rich in fat as possible, and small amounts of cream may sometimes be added without lessening the ease with which it is taken. Cream may also be added to the purée soups and taken on desserts, and be used to replace some of the milk in dishes in which this enters as a constituent. Of other fats, butter and olive oil are the most generally useful. The former should be used freely on bread and other foods of this class at the table, and whenever possible it should be added to food in cooking. In this manner quantities up to six ounces (1450 calories) may sometimes be taken daily. Olive oil may be given on salads, or it may be ordered as a medicine before meals (one-half to one ounce) to reduce a troublesome hyperacidity, or at night (one to two ounces) to correct constipation. The value of cod-liver oil seems to reside largely in its nutritive properties as a fat, and if well borne, it may be freely given. These digestible fats play a most important rôle in the treatment of malnutrition, and much depends upon giving them in such a manner as not to awaken repugnance.

Proteids are an unimportant part of diets which aim to fatten. They are retained within the body to a greater or less extent during overfeeding with any mixed diet, and although their retention may be increased by giving them in large quantities, it is doubtful if this accomplishes any useful purpose. Patients quickly tire of much meat and may suffer digestive disturbances. For this reason meats cannot be forced in the treatment of malnutrition. Eggs, however, are usually well borne, and the addition of raw eggs to milk or to soups, as well as their extensive use in desserts, is of considerable value. Alcoholic drinks play but a minor part in these diets. They furnish a limited amount of extra energy, and may make it easier to take other foods, especially fats. For these reasons they may be used in small amounts, though many discard them altogether.

The following may serve as an example of a fattening diet in which the chief constituent is milk.*

* From Penzoldt and Stintzing, "Handbuch der Therapie," v, 63.

7 A. M.: One pint of milk (drink during thirty minutes).
8 A. M.: A small cup of coffee with cream; 2½ ounces cold roast meat, 3 slices of white bread with butter, a tablespoonful of baked potato.
10 A. M.: ⅔ pint of milk with 3 zwieback.
12 M.: 1 pint of milk (allow thirty minutes for drinking).
1 P. M.: Corn soup, 3 ounces each of some roast and some fowl; mashed potatoes; vegetables; 4 ounces preserved fruit; pudding.
3.30 P. M.: 1 pint of milk (allow thirty minutes for drinking).
5.30 P. M.: ⅔ pint of milk; 2½ ounces cold meat; two slices of white bread with butter.
8.00 P. M.: 2½ ounces cold meat; 4 zwieback; 1 pint of milk.
9.30 P. M.: ⅔ pint of milk, 2 zwieback.

The three quarts of milk contained in this diet alone furnish 1800 calories. In the next example (Boas) little milk is used, the chief reliance being placed upon the digestible fats:

7 A. M.: ½ pint chocolate with cream; 3 or 4 zwieback or 2 rolls; ⅔ to 1 ounce butter.
9.30 A. M.: Cold or warm meats or eggs, white bread, butter, ⅔ ounce, 5 ounces cream.
12 M.: 5 ounces cream, 2 or 3 cakes.
2 P. M.: ½ pint soup; potatoes or vegetables in purée form; meat or fish; salad; preserves; pudding; 1 or 2 glasses cider or other fruit wine.
4.30 P. M.: Coffee or tea with 5 ounces cream; zwieback, cakes, ⅔ ounce butter or honey.
6.00 P. M.: Cold or warm meat; eggs; white bread with ⅔ ounce butter; sweet preserves; glass of cider or malt beer.
9.30 P. M.: ½ pint cream.

The butter in this diet yields about 600 calories, and the 23 ounces of cream about 1200 calories.

Rest.—An important feature in the treatment of nearly every form of malnutrition is a proper amount of rest. Rest in bed diminishes the expenditure of energy by about 12 per cent.; it lessens fever in those with chronic infections; it aids in the discharge of food from the stomach in those with gastric atony, and, finally, it eliminates the depressing exhaustion that so often follows exertion. In those who are nervous and irritable mental rest is as important as bodily rest, and they should be isolated from family and business worries, as prescribed by Weir Mitchell.* Strict confinement to bed is of assistance in the earlier treatment of any severe form of inanition, and only after a substantial improvement in nutrition has occurred should the patient be allowed to get up. Graded and supervised exercises may then be given.

In less severe cases rest in bed is often unnecessary, and partial rest may be substituted. A maximum amount of sleep should be obtained, and if necessary, efforts made to insure this by prescribing such simple measures as early retirement, avoidance of excitement in the evening, and a light supper. Wet-packs at bedtime may sometimes be used to advantage, but hypnotic drugs are to be avoided so far as possible. Specific hours for rest during the day should be prescribed, the best time being just after meals. The amount of exercise should also be controlled, and particular care taken not to prolong exertion to the point of exhaustion. It should not be forgotten, however, that the chief object of treatment is to render the patient more efficient, and that the attempted improvement in nutrition is only a means toward this end. Exercise must, therefore, play an important part in the latter part of the treatment in all cases, for the patient must be fitted to return to the ordinary duties of life. Some patients may do better from the start on moderate exercise unless there is some special complication, such as a fever in tuberculosis. The additional consumption of energy caused by the exercise is more than made up by the increased appetite.

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* Mitchell, Weir: "Fat and Blood," eighth edition, Philadelphia, 1902.

Accessory Measures.—When a patient is put at rest and required to eat large quantities of food, his appetite often seems unequal for the task. Success or failure may then depend upon his ability to follow the necessary orders. His natural will-power, the authority of the physician, the control of a tactful and skilful nurse, or the competition with others having a similar complaint* may convert threatened failure into success. For the lassitude and lack of appetite which so often annoy the patient who is kept at rest Weir Mitchell has recommended massage and electricity, and the former at least has met with general approval for this purpose. Of equal importance are the milder stimulating hydrotherapeutic procedures, such as cold sponges, temperate full baths, and wet-packs. The out-of-door life which has been so successful in the treatment of tuberculosis may also be used to advantage in other forms of chronic malnutrition. Regulated exercise, especially in the open air, is of value in some cases.

Medicines play but a secondary rôle in the treatment of malnutrition, and are generally less useful than the physical therapeutics mentioned above. For its general tonic effect arsenic may be given in the form of Fowler's solution, 3 to 5 minims after meals. Where the appetite is poor, nux vomica and gentian may be given, as in the following prescription:

℞. Tinct. nuc. vom.................................ʒj
Tinct. gent. comp...............................℥ij
Aquæ.....................................℥iv
Sig.—Two teaspoonfuls in a wineglass of water one half-hour before meals.

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* Pratt, J. H.: "The Class Method of Treating Consumption in the Homes of the Poor," Jour. Amer. Med. Assoc., 1907, xlix, 755.

SCURVY

By Albion Walter Hewlett, M.D.

ETIOLOGY

Scurvy is a general nutritional disorder dependent upon improper food. During the seventeenth and eighteenth centuries it was one of the most formidable dangers confronting the crews and passengers on the long sea-voyages so common at that period. It has often broken out in armies on the field, in beleaguered cities, in districts wasted by famine or war, and in prisons and other public institutions of a low order. Within recent years its prevalence has greatly diminished, but it is still one of the most serious dangers encountered by arctic explorers, and is not infrequent among the inhabitants of northern Europe, Asia, and America. It occurs occasionally among the poorer inhabitants of all countries.

Although scurvy is in some way related to errors of diet, the exact nature of this relation is not clear. Infection, intoxication, or the lack of some essential element in the food has each been held responsible for the disease. There is little evidence in favor of the infectious theory of scurvy. The oldest and most generally accepted view of its etiology ascribes it to a lack of certain elements in the food, especially fresh vegetables. More recently an attempt has been made to show that scurvy is due to a chronic intoxication with slightly decomposed food. F. C. Jackson has pointed out that in the arctic regions scurvy most often attacks those who are living largely upon salted or smoked meat and fish, and that these are frequently badly preserved. Together with Harley,* he has shown that a disease somewhat resembling scurvy may be produced in monkeys by feeding them tainted meat. The identity of the two conditions has not been generally accepted, however, and clinical experience seems to show that scurvy may develop when persons are eating little or no meat, but are living upon a diet consisting almost exclusively of breads and meals. Holst and Fröhlich † have produced a disease resembling scurvy by feeding animals on an exclusive meal diet. Possibly Jackson's observations on arctic scurvy indicate the antiscorbutic value of fresh meat, and there seems no necessity at present for giving up the view that scurvy is due to a lack of fresh food in the diet, especially of fresh meat, fresh vegetables, and fresh fruits. Occasionally cases are discovered which are difficult to explain on any hypothesis. The exact element which is absent in the food has not been settled. A deficiency in the potassium salts, the vegetable acids, the vegetable salts, or the alkaline principles of the diet has been assumed by different authors, but there seems to be no definite proof of any hypothesis.

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* Jackson and Harley: "An Experimental Inquiry into Scurvy," Lancet, 1900, i, 1184.

† Holst and Fröhlich: Experimental Studies, etc., On the Etiology of Scurvy, Jour. Hyg., 1907, vii, 634.

PROPHYLAXIS

Measures directed toward the prevention of scurvy should be undertaken whenever the food is liable to become such as to invite the disease, and the possibility of its occurrence should be especially considered in times of war and of famine, and in the preparation for protracted sea-voyages and explorations. Certain conditions seem to predispose to the disease by lowering the resistance of the body. Among these we may mention exposure, dampness, lack of ventilation, monotony of life, and generally depressing surroundings.

In arctic explorations it is often impossible to obtain fresh vegetables over long periods of time, and some of the most severe epidemics in recent times have occurred in the parties of arctic explorers. Nansen's party, however, furnished a brilliant exception to this rule. Though out of touch with civilization for three years, not a single case of scurvy occurred among his men. In preparing the food for his journey an effort was made to combine wholesomeness with variety, and great care was taken to seal the food in tins as a protection against the damp. When Nansen and Johansen left the ship for a sledge journey which lasted fifteen months, they lived largely upon the meat of polar bears which they killed. The Duke of Abruzzi's party* followed Nansen's methods with excellent results. No smoked or salted meats were taken, and all food was either carefully desiccated or sterilized by boiling, and was then carefully sealed in tins. Biscuits and fresh bread were given out regularly. Fresh meats were supplied by the bears and birds, and a certain number of fresh eggs were collected in the months of June and July. Jackson has pointed out the great value of fresh meat for arctic explorers, and has cited several instances to show its superiority over salted meat, even when the latter is taken with lime-juice. And this seems to be the lesson derived from the study of the disease in the arctic regions.

On long sea-voyages it is usually impossible to obtain fresh food of any sort. One reason why the disease has declined so markedly within recent years is the shortening of such voyages. The increase in the number of steam vessels, even for carrying freight, and the more frequent stops of sailing vessels, have done much to eradicate the disease. Whenever a ship touches port it is important that fresh vegetables and meats be taken on board, even though the supply of food is sufficient to last the remainder of the journey. Of vegetable foods which have a high reputation as antiscorbutics we may mention potatoes, oranges, lemons, cabbage, and apples. Preserved vegetables and vegetable juices appear to be less efficient in this regard than the fresh material. Nevertheless they are valuable antiscorbutics when the conditions do not permit the use of the latter. Carefully canned fruits and vegetables, marmelades, sauerkraut, and infusions of malt have been used for this purpose. Lime-juice and lemon-juice were regarded as antiscorbutics by Hawkins and other navigators at the end of the sixteenth century. The general recognition of their value, however, dates from the year 1795, when their introduction into the British navy by Sir Gilbert Blane was followed by an almost complete disappearance of the disease from this service. The more gradual use of lime-juice on merchant ships has effected equally good results. It is recommended that after the fourteenth day of the voyage each sailor should receive one ounce of lime-juice daily, sweetened with sugar and containing a small amount of brandy. The juice should be as fresh and as well preserved as possible, and substitutes such as citric acid avoided. Although the value of lemon-juice as an antiscorbutic cannot be denied, its use does not necessarily protect from scurvy, as has been shown in the case of arctic exploring parties and elsewhere. For this reason no effort should be spared to supply fresh vegetables or fresh meat whenever it is possible.

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* "On the Polar Star," 1903, ii, 672.

The sporadic cases of scurvy which occasionally appear in this country and in England are usually due to a diet consisting almost exclusively of bread or meals, and the same is true of the epidemics which have appeared in recent years in South Africa and India. In such cases, in prisons, and in famine times the use of potatoes and cabbage affords an effective and inexpensive way to avoid the disease.

TREATMENT

No disease is more amenable to proper treatment than is scurvy. When the proper articles of food are given, the symptoms usually disappear as if by magic. An abundant diet of fresh vegetables and meat is most effective in this regard. The patient may be given as many as a dozen oranges a day. In South Africa Macrae * obtained brilliant results by giving a mixed diet, containing half a pound of fresh meat, ten ounces of vegetables, four ounces of jam, and four ounces of fresh fruit daily. He failed to attain equally good results by the addition of four ounces of lime-juice daily to the ordinary meal diet. The use of vegetable salts, such as Rochelle salts, in doses of 30 to 60 grains a day has been recommended by Wright, but the experience with this has not been sufficient to prove its value.

Drugs are of secondary importance in the treatment of scurvy. The use of bitters to improve the appetite, and of iron to combat the anemia, is of value, but without a change in diet they are of little use. Locally the mouth may demand treatment by washes of potassium chlorate or peroxid of hydrogen, and the ulcerated gums may be painted with strong solutions of silver nitrate. The subcutaneous and periarticular hemorrhages should not be treated surgically, and operations of all kinds should be avoided in the active stages of the disease.

* Macrae : "Notes on Scurvy in South Africa," 1902–04, Lancet, London, 1908, i, 1838.

INFANTILE SCURVY (BARLOW'S DISEASE)

By Albion Walter Hewlett, M.D.

ETIOLOGY AND PROPHYLAXIS

In infantile scurvy, as in that of adults, we are dealing with a constitutional disease dependent upon improper diet, and characterized by the tendency to hemorrhages. The collective investigations on infantile scurvy in North America by the American Pediatric Society,* and the German cases reported by Heubner and by those who discussed his paper,† indicate the nature of this disease. It occurs most frequently between the ages of six and fifteen months. Of 356 American cases in which the diet was specified, the food was as follows: breast milk in 12 cases, alone in 10 cases; raw cow's milk in 5 cases, alone in 4 cases; milk, nothing being said about heating, 16 cases, alone in 8 cases; sterilized milk in 107 cases, alone in 68 cases; pasteurized milk in 20 cases, alone in 16 cases; condensed milk in 38 cases, alone in 32 cases; peptonized milk in 14 cases; amylaceous foods, not proprietary, in 24 cases, alone in 6 cases; table food in 12 cases, alone in 11 cases; proprietary amylaceous foods in 214 cases, alone in about 110 cases. It will be seen from this report that the vast majority of the infants that developed scurvy in this country had been fed either on proprietary amylaceous foods or upon sterilized milk. The German experience showed a great preponderance of cases fed on boiled milk, and not a single one of those reported at this discussion occurred in a breast-fed infant. It would appear, therefore, that infantile scurvy is greatly favored by diets which consist largely of sterilized food. Occasionally it has appeared in breast-fed infants, and Concetti ‡ has collected 20 such cases. In many of these the mother's milk was of poor quality, but in others the apparently good quality of the mother's milk shows that much is yet to be learned concerning the exact nature of the disease.

Measures directed toward the prevention of infantile scurvy are based on the above data. Next to breast-feeding, fresh cow's milk, properly modified, is the best form of food. When very pure milk cannot be obtained, especially in cities during the summer months, partial sterilization is necessary, but it should be remembered that the more thorough the sterilization, the greater the danger of scurvy. For this reason pasteurization, heating the milk to 155° F. for twenty minutes, is preferable to boiling or steam sterilization. Farinaceous foods may be used to modify milk, or they may be given as the sole article of diet for a short time, to meet some special emergency, but neither they nor condensed milk should be continued as the only food indefinitely. After an infant is six months old one-half to one ounce of sweet orange-juice or one-fourth to one ounce of beef-juice should be given daily about one-half hour before the noon feeding.

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* Arch. Pediat., 1898, xv, 481.

† Heubner: "Ueber die Barlow'sche Krankheit," Berl. klin. Woch., 1903, xl, 285. Discussion on pp. 307, 353, 374, 443, 462.

‡ Concetti: "Ueber zwei Fällen von Barlowschen Krankheit," Arch. f. Kinderheilk., 1909, i, 174.

TREATMENT

In the treatment of infantile scurvy medicines play but a small part. The diet that has been taken should be immediately discontinued, and fresh cow's milk from a reliable dairy substituted, modifying it to meet the digestive state of the infant. While this is often sufficient in itself, the addition of one-half to two ounces of orange-juice and of equal amounts of beef-juice daily is advisable. Even diarrhea does not contraindicate a trial of fruit-juice. During the active stages of the disease the child should be handled as little as possible, on account of the pain and possible injury to bones or joints. During convalescence iron and cod-liver oil may be given.

RICKETS AND OSTEOMALACIA

By Albion Walter Hewlett, M.D.

RICKETS

Nature of the Disease.—Rickets is a constitutional disease of infants, characterized by changes in the growth of the bones. It is most common between the ages of six and twenty-four months, and after the third year it tends to a spontaneous cure, leaving behind bony deformities in bad cases. Occasionally, the disease remains active or develops in later childhood. While the most manifest changes in rickets are those affecting the bony and cartilaginous tissues, the disease is a constitutional one, and the weak and flaccid muscles, the protruding abdomen, and the abnormal sweating are almost constantly present. Digestive disturbances, respiratory infections, anemia, laryngismus stridulus, and tetany are unusually frequent in rachitic children, though they are probably complications rather than manifestations of the disease.

Etiology and Prophylaxis.—The exact cause of rickets is unknown. It occurs most frequently in the temperate zone, in large cities, and among the children of the poor. The disease often runs in families, but direct heredity seems to play little if any part in its causation. Of much greater importance are the general hygienic surroundings during early life. Bad air, general lack of cleanliness, and absence of sunshine certainly predispose to the disease, though they are probably not direct causes. It is important that infants should be kept in nurseries that are well ventilated and clean, and that they should be placed in the open air as much as possible during the day. Even during the winter a child of four months or over may be well wrapped and placed out of doors for several hours every day, especially during its sleeping periods.

It has been shown that rickets, or at least a similar disease, may be produced in certain animals by confinement in small cages, even though the diets and the hygienic surroundings are apparently excellent,* and Hansemann † speaks of rickets as a disease of domestication. Infants should, therefore, be encouraged to take what exercise they can whenever possible, and life in the open may possibly aid in warding off the disease by stimulating the infant to more active movements. The confinement, bad air, and lack of exercise during the winter months may possibly explain the increased prevalence of the disease at this period of the year.

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* L. Findley: "The Etiology of Rickets: A Clinical and Experimental Study," Brit. Med. Jour., 1908, ii, 13.

† Hansemann: "Ueber Rachitis als Volkskrankheit," Berl. klin. Woch., 1906, xlviii, 249.

The direct cause of rickets is believed by most clinicians to be improper feeding. Emaciation and rickets do not, however, necessarily go together, and an infant may be both fat and rickety. The errors of diet are, therefore, of a qualitative rather than of a general quantitative nature. The disease occurs far more frequently among artificially fed children, and for this reason breast feeding should be employed so far as possible during the first year of life, and especially during the first six months. Yet even breast-fed infants are not immune to rickets, and Holt notes its frequent occurrence among the breast-fed Italian children of New York City. Prolonged or repeated lactations and lactations while pregnant or during poor health have been held accountable for the development of rickets in the infant. When these conditions are present, or when other children in the same family have had the disease, particular care should be taken to see that the hygienic surroundings of the child are beyond reproach. Whenever an infant does not thrive on breast feeding, the mother's milk should be examined, and, if possible, improved. Failing in this, a change may be made to a wet-nurse or to artificial feeding. The continuance of nursing beyond the first year is not to be encouraged.

Among bottle-fed infants rickets occurs most frequently in those whose diet has consisted largely of condensed milk or of starchy foods. Such diets are particularly deficient in fat, and to a lesser extent they are deficient in proteids. The deficit of fat in infants' food is regarded by many (Cheadle, Holt, Still) as an important factor in the etiology of rickets. According to Still, proportions of fat under 2 per cent. for infants under the age of six months involves some risk, and a proportion of fat under 1.5 per cent., given for several months at any period of infancy, involves a high probability of rickets. The disease is also said to have been produced in captive animals by reducing the fat in their diets.* Next to good mother's milk the best antirachitic diet is cow's milk, modified to furnish approximately the same proportions of fat and proteids as are contained in human milk. This modification may be accomplished at home without difficulty by the use of the well-known mixtures of cream, milk, and water. High dilutions of cow's milk, either with water or with the various gruels, is inadvisable, except to meet special emergencies, because the fat is thereby reduced far below that contained in mother's milk. During early infancy the extensive use of amylaceous foods is said to be directly conducive to rickets, and such use should be condemned. In the latter part of the first year, however, when there is no longer a necessity for high dilutions, gruels may be used as diluents of the milk, in the proportion of about one part of gruel to three parts of milk. In the second year cow's milk should remain the principal article of diet, but limited amounts of soft-boiled eggs, meat-juice, scraped beef, baked potato, etc., may be given. The use at this time of a diet consisting largely of starchy food is to be especially condemned.

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* Bland-Sutton, quoted by Cheadle and Poynton: Allbutt and Rolleston's "System of Medicine," iii, 78.

Digestive disturbances have often been held to be responsible for rickets, and the abdominal distention so common in this disease seems to bear out this assumption. It is often difficult, however, to estimate the exact relation between the two, and in some cases the digestive symptoms seem to be secondary. On the other hand, any factor which reduces an infant's general nutrition seems to predispose to rickets, and fat losses in the stools, which are equivalent to a lessened amount of fat in the diet, may be especially important from an etiologic standpoint. It seems probable that the avoidance of digestive disturbances during infancy diminishes the general tendency to rickets. The rapid advancement in our knowledge of infant feeding and the application of this wider knowledge to social problems will undoubtedly tend to lessen the frequency and severity of rickets among the poor of the large cities.

The insufficient deposit of lime salts in the bones of rachitic children has naturally raised the question as to whether or not these salts are supplied to the tissues in adequate quantity. If young animals are fed on a diet deficient in the salts of calcium, the bones become soft and bend easily. The histologic appearances, however, differ from those in rickets, and most authorities regard the two as distinct conditions. Moreover, studies of the diets taken by rachitic children show that, as a rule, there is no deficit of calcium salts in their food, and studies of their urine during the administration of calcium show that lime salts are absorbed. Finally, clinical experience has shown that calcium salts cannot be relied upon either to prevent or to cure rickets. The error of metabolism seems to lie in the bony tissues themselves, which fail to utilize the salts at hand. It is possible that a disease due to lack of calcium salts in the diet may occur in infants as well as in animals—the so-called pseudorachitic osteoporosis.* This should be preventable and curable by the administration of sufficient calcium salts in the food.

Treatment.—In the treatment of rickets, reliance is placed mainly upon hygiene and diet, on the one hand, and upon cod-liver oil and phosphorus on the other. The nursery should be sunny, clean, and dry. It should be well ventilated at all times, and thoroughly aired whenever the child is out. Life in the open air is of great importance. Even in winter the infant should be warmly clad and kept out as much as possible during the day, especially during the sleeping periods, and in summer it may be kept out of doors both day and night. Removal to the country or to the seashore during the summer months is very beneficial. The establishment of charity hospitals for this purpose will enable many infants of poor parents in large cities to escape rickets as well as other disorders.

Hydrotherapeutic measures are of considerable value, not only in improving the general nutrition, but in lessening the liability to pulmonary complications. If the bath-room is warm, even small infants can be douched or sponged with cool water at the end of a warm cleansing bath. At first, water of about 80° F. may be used for this purpose, but later, as the infant grows accustomed to this, the temperature of the douche may be lowered to 75° or 70° F. Baths in salt water have also been highly recommended for rickets. A moderate amount of friction and gentle massage after the bath are beneficial.

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* Schabad: "Der Kalk in der Pathologic der Rachitis," Berl. klin. Woch., 1909, xlvi, 823.

A change in diet is essential. If the infant has been nursing, the mother's milk should be examined, and efforts made to improve its quality. Failing in this, the child must be weaned or given to a wet-nurse. The best artificial food is cow's milk, properly modified to meet the digestive state of the infant. Cream mixtures permit the giving of adequate quantities of fat, without increasing the quantity of proteids. This seems to be important in the treatment of rickets, for as much fat as possible should be taken without disturbing digestion. The stools, however, must be carefully watched for any signs of insufficient fat absorption. Condensed milk and farinaceous foods are to be especially avoided.

Of medicines, cod-liver oil enjoys the highest reputation, and clinicians generally agree as to its great value in the treatment of rickets. Metabolic studies have shown that it increases the retention of calcium and of phosphates in the bodies of rachitic infants.* By some (Cheadle) it is held that other fats are equally beneficial in rickets, but Schabad could demonstrate no increased retention of calcium salts when sesame oil was given to a rachitic child. Cod-liver oil may be given to an infant of six months in doses of 15 minims three times a day, and increased, according to the age and condition of the child, up to 30 or more minims at eighteen or twenty-four months. Better results are often obtained with these small doses over long periods of time, than if larger doses are used. The official emulsion of cod-liver oil (50 per cent.) is sometimes better borne than the pure oil. Should the oil cause diarrhea, an emulsion with equal parts of lime-water may be given (Cheadle). Olive oil and cotton-seed oil have been used as substitutes for cod-liver oil, but it is not certain that they give equally beneficial results. The yolk of egg also contains considerable fat in a natural emulsion, and it may be given to infants of ten months or over.

The value of phosphorus in the treatment of rickets has not been universally accepted. Many clinicians (Kassowitz, Jacobi, Biedert, Stöltzner) favor its use, while others (Holt, Baginski, Monti) regard it as of doubtful or of no value. According to Schabad, it does not affect calcium retention in rachitic infants when given alone, but its addition to cod-liver oil materially increases the retention due to that substance. Clinically, phosphorus appears to be of especial value when the symptoms of nervous hyperirritability, such as laryngismus stridulus and tetany, are prominent manifestations. The dose for an infant is $\frac{1}{200}$ grain three times a day, either in pill form or dissolved in oil. The effect upon nervous symptoms may appear very promptly, but in general the treatment should be kept up for several months.

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* Schabad: Zeit. f. klin. Med., 1908–09, lxvii, 454; 1909, lxviii, 94; 1910, xlxix, 435.

The administration of calcium salts appears to be of little value, either in the prevention or the treatment of rickets, for the disease is not due to a deficient supply of these salts, but to an inability on the part of the bony tissues to utilize them, and, as a rule, the supply in the food is ample to cover the needs of the body. During the reparative processes, however, there is an unusual need for calcium salts. These may be given in the form of the official syrup of calcium lactophosphate or the syrup of hypophosphites in doses of one-half to one teaspoonful three times a day.

Adrenalin has recently been recommended as an antirachitic drug, but the experience with it thus far does not indicate that it is likely to replace cod-liver oil and phosphorus.*

Other drugs are of use in the symptomatic treatment of rickets. Arsenic and iron have been used for the anemia. Atropin in minute doses will control the profuse sweats.

Bony Deformities.—The chief osseous deformities of rickets are due to the yielding of the softened bones under the mechanical strains to which they are subjected. As the disease passes off these deformities tend to right themselves, but in severe cases the patient may be left with a deformed thorax, a contracted pelvis, a spinal curvature, or bent long bones. During the active stages of the disease every effort should be made to reduce the mechanical strain upon the osseous system. Particular pains should be taken to avoid habitual postures, such as sitting cross-legged, being carried over one arm of the nurse, etc. It is best to keep the infant in bed for the greater part of the day. The latter should be flat and rather hard, with no pillow beneath the head. If there is a tendency to kyphosis, a small pillow may be placed beneath the back, opposite the main curvature, and when the child sits up, the back should be supported. Two or three times each day the patient may be turned upon its face, the buttocks lifted, and the back pressed downward so as to correct the deformity. During the active stages of the disease the infant should not be allowed to stand, and the use of long splints which extend beyond the feet will prevent efforts to do so. While in bed, however, these splints should be taken off so as to allow free movement of the legs. During the earlier stages something may be done to straighten bent limbs by gentle and intelligent manipulations, but after the child is two and a half years old, the bones are usually too hard to yield to such measures. In such cases it is well to wait in order to ascertain to what extent the deformities will correct themselves, and in severe cases to advise surgical interference at about the fifth year.

The thoracic deformities of rickets do not permit of ready mechanical treatment. The pneumatic cabinet has been advised, but apparently not much used. In craniotabes, a small air-cushion, about one-half filled, will distribute the pressure evenly over the skull, and in these cases phosphorus seems to act particularly well.

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* Stoeltzner: "Korreferat über Rachitis und Osteomalacie," Verh. d. deut. path. Gesellsch., 1909, 20. See also discussion.

As the patient improves particular care should be taken not to allow him to get about too early. If he has been walking previous to the onset of the disease, he should be kept off his feet for at least three months after beginning treatment, and if he has not yet begun to walk, he should not be encouraged to do so.

Gastro-intestinal Complications.—These often present serious obstacles to the treatment of rickets, for they not only restrict the choice of diet, but they may cause serious losses, especially of fats, through lack of absorption. These complications are treated according to the general principles governing the treatment of gastro-intestinal diseases in infants. Especial effort should be made, however, not to continue too long on a diet rich in carbohydrates or poor in fats. During acute symptoms cod-liver oil is contraindicated.

Respiratory Infections.—Bronchitis and bronchopneumonia are common in rachitic infants, and are particularly dangerous on account of the general debility and the thoracic deformities. They are more apt to occur in those who have been kept continually in overheated and badly ventilated rooms, and they are best guarded against by plenty of fresh air, cool sponges, and care in using warm clothing when the infant is to be exposed to the cold. In treating respiratory infections it should be remembered that rachitic children are not very tolerant of depressing remedies, such as aconite and the coal-tar derivatives.

Nervous Complications.—The abnormal irritability of the nerve-centers of rachitic children, especially those with craniotabes, is shown by the frequent occurrence of laryngismus stridulus, tetany, and convulsions. When these occur, attention should first be directed to the possibility of reflex irritation. The intestines should be cleaned out by a cathartic, and if intestinal worms are present, a vermifuge should be given; enlarged tonsils, elongated uvula, or adenoid growths may be removed; or the gum may be lanced if a tooth is about to break through. The general increase of nervous irritability is best combated by bromids and chloral. After a serious nervous manifestation an infant of one year may receive 3 to 5 grains of chloral hydrate by rectum every three hours until the effect of the hypnotic is evident. Then a combination of sodium bromid, 5 grains, and chloral hydrate, 2 grains, may be given three or four times a day until the general condition has improved. The treatment of the underlying rickets should begin immediately, and in these cases phosphorus has shown itself to be of particular value.

OSTEOMALACIA

Nature of the Disease.—Osteomalacia is a chronic disease, characterized by pains and by a decalcification of the bones, which renders them liable to bend and to fracture with abnormal ease. It is relatively common in certain foci of continental Europe, but it is rare in Great Britain and in the United States. It occurs most frequently between the ages of twenty and forty years, though it may occur in younger as well as in older individuals. The disease is far more common in women than in men, mainly because it is so frequently associated with repeated pregnancies or prolonged lactations. The decalcification of the bone in osteomalacia suggests a relation to rickets, but the exact connection between them is uncertain. The two differ in the ages at which they develop, in the finer changes in the bones, and in the tendency of osteomalacia to continue for years with exacerbations and remissions. The cause of the decalcification in osteomalacia has not been determined. The bony changes resemble those produced in animals by a diet deficient in calcium salts, but such a deficit does not seem to have been present in many cases developing spontaneously in man, and the administration of these salts appears to have had but little influence upon the course of the disease. As in rickets, the metabolism seems to be altered in such a manner that calcium salts are not properly utilized by the bones. There is no proof for the assumption that this is due to an acid intoxication, either from acid food or from acids formed in the body. The relation of osteomalacia to pregnancy and to lactation is interesting and important, for both conditions require unusual quantities of lime salts, and, therefore, may disturb the normal bony metabolism.*

Treatment.—Owing to the chronic course of osteomalacia, the remissions, and the occasional spontaneous cures, it is difficult to estimate the effect of any treatment, and it is probable that many patients reported as cured have subsequently relapsed.

It is believed that the course of the disease is favorably influenced by all measures which improve the general nutrition of the body. Rest, fresh air, baths, and massage are, therefore, of considerable value. The diet should be abundant, especially if the patient is underweight, and, in addition, it is well to give an abundance of food rich in phosphates and calcium salts, such as milk, eggs, and peas.

Of medicines, phosphorus enjoys the highest reputation. This should be given in daily doses of $\frac{1}{30}$ to $\frac{1}{15}$ grain. It may be administered as the official phosphorus pills, each of which contains $\frac{1}{100}$ grain, or it may be given dissolved in oil. To be of value, phosphorus must be taken over long periods of time,—several months at least,—and the first signs of improvement, usually a lessening of the pains, may not become evident for three or four weeks. Even though the patient has apparently recovered, the danger of a relapse should be kept in mind, and the treatment begun again if rheumatic pains return. The reported results of the phosphorus treatment of osteomalacia have been very favorable. Of 80 cases collected from the literature by Laufer,† 40 recovered and 36 were improved. The drug seems to stimulate new bone formation, and in the few cases in which metabolic studies have been made during its administration, a distinct retention of calcium in the body was found.*

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* McCrudden: "Studies of Bone Metabolism, Especially the Pathological Process, Etiology, and Treatment of Osteomalacia," Arch. Int. Med., 1910, v, 596.

† Laufer: "Zur Pathologie und Therapie der Osteomalacie des Weibes," Zentralbl. f. d. Grenzgeb. d. Med. u. Chir., 1900, iii, 292.

The administration of calcium salts has not been attended with any considerable success in the treatment of osteomalacia. It is improbable that the disease is due to a deficit of these salts in the food, and a proper diet will certainly furnish them in excess of the body needs. The unfavorable effects of pregnancy and of lactation are probably due to an increased demand for these salts, which causes a disturbance of their metabolism in the body. At any rate, the avoidance of pregnancy and of lactation is extremely important in guarding against exacerbations or relapses. In cows the progress of the disease has been checked by stopping milking.†

Although the favorable effect produced upon the disease by removal of the ovaries had been previously noted, attention was especially directed to this treatment by Fehling in 1887. He advanced the hypothesis that osteomalacia was due to an increased functional activity of the ovaries, which caused a dilatation of the vessels in the bones and an absorption of lime salts, and he advocated removal of the ovaries to cure the disease. Fehling's hypothesis has not been generally accepted, but his method of treatment has yielded good results. According to Laufer's collection of case reports, from 60 to 70 per cent. of patients have recovered after removal of the ovaries, and many more have been benefited. The improvement after operation is often remarkably prompt, so that there is little doubt about its relation to the treatment. The failure of castration in many cases and the occurrence of the disease in men show, however, that the disease is not necessarily due to an excessive ovarian function. In most cases, operation should not be performed until medical treatment, especially that with phosphorus and hygiene, has been given a thorough trial. Removal of the ovaries is indicated when medical treatment has failed or when, on account of a contractedpelv is, Cesarean section is necessary. Should the disease first appear during pregnancy, or should an exacerbation occur at this time in a woman whose pelvis is not yet contracted, an abortion may be advisable in order to check the disease, and with the hope that, by internal treatment, the disease will disappear and a child be obtained at some later time.

Stimulated by the hypothesis that osteomalacia is due to an excessive activity of the ovaries, treatment with various organs of internal secretion or with their antibodies has been advocated by various authors. Of these, the adrenalin treatment, as recommended by Bossi,‡ has received most attention. According to his method, subcutaneous injections of about 0.5 c.c. of the 1:1000 solution of adrenalin are given every day or every other day. Such injections may cause unpleasant symptoms, especially rapid pulse, palpitation, blanching of the face, and tremor. The results reported indicate that this treatment is attended with success in a fair proportion of cases, and that it is perhaps worth a trial when phosphorus has failed and operation seems inadvisable. As with phosphorus, the treatment must often be prolonged over months before much improvement is seen.

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* Hotz, G.: "Phosphor säure und Kalkstoffwechsel bei Osteomalacie unter dem Einfluss der Phosphortherapie," Zeit. f. exp. Path. u. Ther., 1906, iii, 605.

† Rievel: "Knochenpathologie der Tiere," Ergeb. d. allgem. Path. u. path. Anat., 1907, xi, ii, 590.

‡ Bossi: Zentralbl. f. Gynäk., 1907, xxxi, 69, 172.

Of the symptoms requiring special attention in osteomalacia, the pain is the most troublesome. Warm baths, màssage, or the coal-tar derivatives are often of value, but if the pain is severe, morphin may be necessary for its relief. In order to diminish the osseous deformities, care should be taken not to subject the bones to any unnecessary mechanical strains, and rest in bed is necessary in severe cases.

ARTHRITIS DEFORMANS

By Thomas B. Futcher, M.B.

This is a disease of the joints of doubtful etiology and with a marked tendency to chronicity, characterized by changes in the synovial membranes and periarticular structures, and often by atrophic and hypertrophic changes in the bones, leading to marked joint deformity.

Etiology.—We must rid our minds of the idea that there is any association between this disease and rheumatism or gout, and consequently should abandon the names *rheumatoid arthritis* and *rheumatic gout*.

Two chief views prevail as to the etiology of arthritis deformans. According to one, it is of nervous origin; according to the other, it is the result of a chronic infection. The balance of opinion at the present day is that the disease is due to some bacterial agent. Various organisms have been isolated from the joints, but as yet no specific germ has been found. The acute onset, with fever, the polyarthritis, the presence of enlarged glands, and the frequent enlargement of the spleen are all extremely suggestive of an infection. This is particularly true of the type that occurs in children—the so-called Still's disease, in which glandular and splenic enlargement are especially common. Although there is less evidence that the chronic cases with atrophic and hypertrophic changes in the bone are due to a bacterial agent, yet it is quite possible that these changes are primarily induced by the action of some organism.

Males and females appear to be about equally affected, although some statistics show a preponderance in the latter. The majority of cases occur between the ages of thirty and fifty.

Classification.—It is very difficult to give a satisfactory classification of the various types of the disease. This is impressed on one by noting the different types of the disease as described in the various text-books. The knowledge acquired by radiographs and by the operative treatment in recent years has simplified matters considerably. The classification to be followed here is, with some modifications, that adopted by Goldthwait and his associates. It is as follows:

1. *Chronic Villous Arthritis or "Dry Joint."*—This is a very common condition, and, in my own experience, is most often seen in women, in whom it affects most frequently the knee-joints. It is characterized briefly by a certain amount of stiffness and pain early in the day on moving about, and particularly on going up-stairs. The

patient is conscious of a certain amount of grating or creaking in the joint, and the physician can appreciate this by holding the hand over the affected joint during active or passive motion. The condition is essentially produced by villous outgrowths from the synovial membrane. These villi become interposed between the articular surfaces, causing the impaired function and the crepitation. There is no loss of the articular cartilage, and the appearance of the joint is not materially changed. There may, in fact, be an excess of synovial fluid. There is no tendency to progression from joint to joint.

2. *Atrophic Arthritis, Including the Arthritis Deformans of Children, or Still's Disease.*—The cases of so-called "rheumatoid arthritis" belong to this group. In the early stages of this form the joints are acutely inflamed and swollen. The swelling is due in part to effusion into the joint and to infiltration of the periarticular structures. Even in the early stages erosion of the cartilage and loss of bone substance may be demonstrated by the radiograph. The affection is polyarticular, and repeated acute exacerbations occur. Eventually atrophy of all the structures entering into the joint occurs, and one bone may become telescoped into another. Although the statement is made that the lymphatic glands are not enlarged, I have seen occasional cases in the acute stages in adults in which not only the lymphatic glands, but also the spleen, have been enlarged. The features of the acute stage of this form point strongly in favor of a bacterial infection.

Although the type of the disease seen in children, the form specially studied by Still, is usually classified under a separate heading, it is included here, owing to the strong resemblance it bears to the acute stages of the atrophic form. It is characterized by multiple fusiform swellings of the smaller and larger joints, associated with marked enlargement of the lymphatic glands and spleen. If not properly treated at the beginning, the disease becomes chronic and progressive. The evidences of actual atrophy of the articular structures are not as yet well established, but, according to the simple classification here adopted, the type in children seems to fall most naturally in this group. The clinical features of the affection in children suggest very strongly that it is due to a chronic infection.

3. *Hypertrophic Arthritis.*—The term "osteoarthritis" has frequently been applied to this form. This type is characterized essentially by thickening at the edges of the articular cartilages or at the attachment of the ligaments, forming ridges or nodes which become ossified, thus interfering with the motion of the joint. The process may be limited to one joint or numerous joints may be affected. Although more likely to be subacute in character, acute exacerbations of the disease in the joints involved may occur. It is chronic and progressive in character, and eventually leads to marked fixation and deformity. The bony outgrowths or osteophytes are clearly revealed by the radiographs.

In the fingers this type is represented by the Heberden's nodes and Haygarth's nodosities. Most of the cases of arthritis deformans of the spine belong to this group. They constitute the cases of *spondylitis deformans*, or "poker-back." Hypertrophy of the bone along the anterolateral ligaments and at the margins of the intervertebral discs causes an interlocking of the vertebræ and the resulting stiff spine. Whether any of the vertebral forms are due primarily to a meningitis, as von Bechterew believes, is still an open question. The monarticular cases, involving the shoulder- or hip-joints—the *spondylose rhizomélique* cases—anatomically may belong either to the atrophic or hypertrophic form. The same may be said of the *morbus coxæ senilis* cases involving the hip-joint.

Goldthwait and his associates have a fourth class, which they call the "infectious arthritis" group. Here they include the cases of arthritis deformans which they consider are due to some bacterial agent, just as a gonorrheal, typhoid, or pneumococcal arthritis is due to the gonococcus, typhoid bacillus, or pneumococcus, respectively. The writer refrains, however, from including this group as a separate class. He prefers to believe that these cases represent the acute stages of either the atrophic or hypertrophic form, and that these acute cases can merge gradually into the type characterized by atrophy or hypertrophy of the joint structures. Whether the atrophic or hypertrophic types are sequels of the acute cases, apparently due to a bacterial infection, or whether they represent two entirely separate forms of the disease, is still an open question, however.

Pathology.—Most of the salient points in the pathology have already been given in the consideration of the types of the disease. In the rare instances in which a joint has been examined in the acute stages the capsule is more vascular and redder than normal. The joint surface often has a velvety appearance, or it may be covered by a more or less organized membrane resembling granulation tissue. Goldthwait and his coworkers, Painter and Osgood, have made some careful studies of the metabolism in this disease, and the following quotation expresses briefly their conclusions: "In all the cases the phosphorus in the urine was rather low, the calcium high, and the magnesium low, and in all the cases of atrophic arthritis and hypertrophic arthritis there was a loss of calcium by the body, and, on the other hand, a retention of magnesium."

TREATMENT

Only the medical measures will be considered here, the surgical procedures being dealt with under a separate section.

In no affection is an early diagnosis more important in securing the best possible results from the medical treatment than in this disease. In the acute stages, with multiple involvement of the joints, arthritis deformans closely simulates and is too often mistaken for acute articular rheumatism. If we constantly kept in mind that acute attacks of arthritis deformans are nearly always followed by slight periarticular thickening and disability of the affected joints, whereas after acute articular rheumatism the joints practically always resume their normal appearance and function, we would be less likely to confuse the two diseases in their early stages. Too often in the chronic cases with deformity the disease is mistaken for gout, or the physician considers that there is a gouty factor in the case. As a result, it frequently happens that the unfortunate victim is placed on a low diet and the meats and various proteids, so essential to keeping up the patient's weight and strength, are consequently cut off.

Much, undoubtedly, can be done in retarding, and, I believe, in rare instances, entirely stopping, the disease if proper treatment is begun in the early stages. Unfortunately, however, it is often progressive from the start, and leads to a crippling of the joints which makes the affection one of the most distressing physicians have to deal with. Even in these cases much can be done to alleviate the victim's suffering and to lessen the tendency to joint deformity.

Careful nursing is a most important factor in the treatment of the disease. In the chronic cases it is very essential that a nurse with the proper disposition be chosen. Not every nurse, or physician either, possesses the necessary sympathy and patience to care for these cases. A striking feature of the disease, in women particularly, is the extreme nervousness and depression in spirits of its victims, and it is most essential that the nurse in charge shall be one with a sympathetic disposition and one willing to put up with petty annoyances. Nothing is more wearing on the visiting physician than the list of complaints he has to listen to from his patient month after month.

1. **Treatment of the Acute Febrile Cases.**—Rest in bed is essential in the early stages. The *diet*, at first, should consist of easily assimilated foods, such as milk, broths, and eggs. With the subsidence of the pain and fever the patient should be urged to take good, simple, nutritious foods in abundance. The beef-juices and more digestible meats should be eaten freely, and not restricted, as they too often are.

The *local treatment* of the joints is most important. If the pain be severe, considerable relief may be afforded by the protection and warmth provided by wrapping the joints in thick layers of raw cotton held in place by a many-tailed bandage. Wet compresses may be applied to the affected joint. The experience in each individual case must teach us whether warm or cold compresses should be used. As a rule, the warm, wet compresses give the most relief. The cold compresses may be tried, however. They should be applied at night and allowed to remain on until the following morning. A towel or several layers of lint or flannel are wrung out of cold water, wrapped about the affected joint or joints, and surrounded by a layer of oiled silk kept in position by a light bandage. Applied in this way the compress acts as a poultice. Where the pain is severe, a sedative lotion may be used. For this purpose compresses soaked in lead and opium lotion and applied to the joint may be tried and sometimes give relief.

In recent years Bier's treatment of joint affections has been tried in various quarters for the relief of the pain in arthritis deformans. It consists in causing a passive hyperemia of the affected joint by compressing the veins above it (Hyperämie als Heilmittel, von Professor August Bier, Leipzig, Verlag von F. C. Vogel, 1903). It is claimed for the treatment that it not only tends to relieve the pain in joint affections, but also to have a curative effect on the disease. To carry out Bier's treatment a flat rubber band, such as an Esmarch bandage, is wound three or four times about the extremity above the affected joint. The end of the bandage is kept in position by a safety-pin. To give some protection to the skin the bandage is applied over a layer or two of some material, such as surgeon's lint. The bandage must not be applied too tightly, otherwise the pain will be aggravated. It should occasion no tingling, numbness, or paresthesia of any kind in the extremity. Notwithstanding this light application of the bandage, a certain amount of constriction of the veins results, with hyperemia of the extremity and consequently of the affected joint. To increase the hyperemia of the joint itself, let us say, the elbow or knee, an ordinary bandage may be applied from the hand or foot up to the affected joint. Bier directs that the bandage should be kept applied continuously with short intermissions. My own experience and our experience at the Johns Hopkins Hospital have been too limited to express a very definite opinion as to the efficacy of this form of treatment. Although there has been relief in some, the pain has been appreciably aggravated in others. If satisfactory results do not follow the first application, the treatment should not be abandoned. It may be that the bandage has been applied too tightly. It is also well to vary the method and to apply the bandage for a few minutes, say, ten or fifteen, several times a day at first, and then to gradually increase the length of time the bandage is in position.

In the very acute stages, when the pain is very intense, the hot-air treatment is not feasible, but as soon as the acuter manifestations have subsided, baking the joints should be tried. The joint, well protected by flannel to prevent possible burning, should be baked once daily for an average of twenty minutes with the temperature of the oven at 130° C. Where there are several joints involved, one may be treated in the morning and another in the afternoon. In many cases the hot-air treatment is undoubtedly most beneficial, but, like all other therapeutic measures in this disease, has its failures. It not infrequently ameliorates the pain and seems to hasten the absorption of the joint effusion and of the periarticular thickening.

With the subsidence of the acute pain massage should be at once started. It is the most efficient single remedy we possess in preventing the periarticular thickenings and joint contractures so likely to follow after the acute exacerbations. Where the patient can afford it, the massage should be kept up during the acute attack and for weeks afterward. Not only should the joints be thoroughly massaged, but the adjacent muscles also should receive careful attention in order to counteract the muscular atrophy and the tendency to contracture of their tendons.

During the acute stages the *medicinal* treatment is directed in part toward the alleviation of the pain. We have no drug on which we can constantly rely. A remedy which in one case will tend to relieve the pain will have no influence whatever in another. Consequently it is necessary in each individual case to find the drug that gives greatest relief. The salicylic preparations give the best results. Sodium salicylate, in 15- to 20-grain doses every four hours at first, may be tried. If this preparation does not relieve the pain in forty-eight hours, some other drug should be substituted. I have found aspirin (acetyl-salicylic acid), even in 5- or 10-grain doses in capsules, give marked relief in some cases. It may be given, however, up to 20 grains to the dose. A combination of salol and phenacetin, 5 grains of each, may be tried. Occasionally, carbonate of guaiacol, in 3- to 5-grain doses every four hours, seems to relieve the pain. It is sometimes alleviated by the administration of one of the bromids, which are especially indicated when nervousness is a prominent feature in the case. Resort to the preparations of opium should be avoided, as the persistency of the pain endangers the contraction of the morphin habit.

We possess no drugs that seem to have any direct action on the morbid process itself. It is most essential, however, that the patient should be given a good general tonic. Preparations of arsenic and iron appear to give the best results. Fowler's solution of arsenic should be started in 3-minim doses after each meal, gradually increasing the dose until the patient takes 10 or 15 minims three times daily. The drug may be alternated with iron, of which the iodid seems to be the best preparation. The syrup of the iodid of iron should be administered in 15- to 20-minim doses three times daily after meals. These remedies should be continued for months after the subsidence of the acute symptoms. I am fully convinced that they do a great deal of good in many cases. Cod-liver oil is also a very useful general tonic.

The bowels should be regulated by mild laxatives. Many of the patients drink very little water. They should be encouraged to drink water freely.

It must be emphasized here that there must be no let-up in the treatment of arthritis deformans in its earliest stages. It is only by persevering, by keeping up the general body resistance by tonics, and by continuing the massage that we can hope to avoid the distressing deformities of the joints that make the disease such a serious affection in the chronic stage.

Arthritis Deformans in Children, or Still's Disease.—This interesting form of the disease deserves a few words of special mention. The same general treatment applies here as in the forms manifested in the adult. With patience and perseverance the condition can be entirely cured. Five years ago a boy, aged four years, was admitted to Dr. Osler's wards in the Johns Hopkins Hospital. There were fusiform swellings of the interphalangeal, wrist, elbow-, ankle-, and knee-joints. There was high fever. The pain was very intense, and he could not be turned in bed without causing excruciating pain. All the superficial glands, including the epitrochlears, and the spleen were markedly enlarged. With rest, local protection of the joint, and gradually increasing doses of Fowler's solution the joint condition began to improve. Eventually, it was possible to begin massage and systematic baking of the joints. These, with good-sized doses of Fowler's solution, were kept up for a year, at the end of which time the boy was discharged from the hospital practically well.

2. **Treatment of the Chronic Cases.**—Although the medical treatment in the chronic stages of the disease is in most cases rather discouraging, yet much can be done to alleviate the patient's sufferings, to retard the progress of the disease, and to lessen the joint deformity. With persistency in the treatment victims who have been practically bedridden may occasionally improve to such an extent as to permit them to get about with a moderate degree of comfort and freedom.

(1) *The Chronic Villous Arthritis.*—As a rule, the general health in these cases is but little impaired. Where it is below par, it should be improved as much as possible by good food, fresh air, and general tonics.

As this form is due in part to a lowering in tone of the structures entering into the joint, their tone should be increased as much as possible. The muscles above and below the joint should be developed, and this is best effected by massage in its various forms. Bathing the muscles with cold water, followed by thorough friction, is beneficial. The joints themselves should be massaged, and baking should be given a thorough trial. "Sweating" the joint by incasing it in rubber-dam is helpful. All exercises that produce unusual strain on the joint, such as stair-climbing in case of the knee, should be avoided. In walking, considerable support to the knee can be given by the firm application of a flannel bandage. As flat-foot is a frequent accompaniment and a partial factor in causing villous arthritis of the knee-joint, this deformity should always be corrected when present.

(2) *The Chronic Atrophic and Hypertrophic Arthritis.*—As the general principles governing the treatment in these two forms is very similar, they will be considered together.

It is well for the physician, when he is first called in to see a case presenting either of these forms of the disease in their later stages, to at once inform the patient's friends of the progressive character of the affection in most of the cases, and of the fact that in a certain percentage of the patients the results of treatment are most unsatisfactory, despite any course of treatment that may be prescribed. In this manner he in a measure protects himself, for in the majority of cases he is not the last physician to be called in.

(*a*) *General Hygiene and Diet.*—The patients should have plenty of fresh air and sunshine. Too often they are inclined to shut themselves in a room to avoid currents of air to which they become specially sensitive. Undoubtedly they are more comfortable in a warm climate, and those whose means will permit it should endeavor to spend their winters in the south. The diet is of the utmost importance. The physician often does material harm by cutting down the dietary of these cases. As Osler forcibly puts it, "So many persons are afflicted not only with the disease, but reduced by dieting, that I often find 'full diet' the best prescription." It is too often found that meats have been cut off. These, together with eggs, should be freely allowed. The patients should be encouraged to drink water, and an alkali, such as cream of tartar, may be added. The lighter wines are permissible. Their effect should be carefully watched, however. I have occasionally seen a case in which the arthritic symptoms have apparently been aggravated by their use.

(*b*) *Local Treatment.*—Undoubtedly massage, not only of the affected joints, but also of the neighboring muscles, is of the utmost importance. It should be kept up for months. The patients are likely to tire of the treatment, so it is well to omit the massage for a couple of weeks at long intervals in order to give them an occasional respite. Any tendency to contractures of the joints must be overcome as much as possible by massage and passive motion. Contracture of the fingers may be obviated or even overcome by lightly bandaging the hand to an anterior splint overnight.

In the earlier stages of the hypertrophic type Goldthwait advocates immobilizing the joints with the hope of retarding the development of the osteophytic outgrowths. In the spondylitis deformans cases, plaster jackets or braces are advisable to fix the spine. In hip-joint or shoulder cases a plaster-of-Paris bandage should be applied.

In both types baking the joints in the hot-air oven should be given a thorough trial. This is especially applicable in the atrophic type, in which the joints of the extremities are more likely to be involved.

Bier's hyperemia treatment, in the manner already described, may be tried. "Sweating" the joint by the application of the rubber-dam is sometimes helpful.

(*c*) *Hydrotherapy.*—This may be carried out to a limited extent at home by the use of hot baths and the application of hot or cold compresses to the painful joints at night. The hydrotherapy treatment at spas has not proved very satisfactory. The Hot Springs, Bath County, Va., the Hot Springs, Arkansas, the St. Catharine Springs, Ont., Canada, and those of Bath, England, may be helpful. Cases are often made worse, however, at different spas, from overuse of the baths, and in part from a reducing diet.

Medicinal Treatment.—For the pain, the salicylic acid preparations, as described in the treatment of the acute forms, appear to give most relief. In the chronic cases, however, they should not be given in as large doses as in the acute stages, owing to their depressing influence on the circulation.

The general health should be improved as much as possible by the use of good tonics. Alternate courses of Fowler's solution and syrup of the iodid of iron should be kept up for many months. Where there is very much periarticular thickening, potassium iodid, in 5- or 10-grain doses three times daily after meals, may prove of service.

The appetite of these patients is usually markedly impaired, and it should be encouraged by the administration of some simple bitter tonic, such as nux vomica or gentian, before meals. Mild laxatives should be given to regulate the bowels.

GOUT

By Thomas B. Futcher, M.B.

Gout is a disorder of proteid metabolism manifested chiefly by an excess of uric acid in the circulating blood, and by the deposition of sodium biurate in and about the joints and in the tissues, giving rise to the local symptoms of the disease.

Etiology.—We know that gout is intimately associated with the metabolism of uric acid and the closely allied purin or xanthin bases. A satisfactory explanation, upon which all investigators can agree, showing the true bearing of this metabolic disturbance on the disease, is still lacking. The recent demonstration that the chemical changes in the nucleoproteids of the body are due to the action of special organic ferments in the various glands and tissues holds out hope to us that we may soon arrive at a true explanation of gout. In discussing the etiology we must consider the causative factors under three heads: (1) The predisposing; (2) the exciting; and (3) the metabolic causes.

1. *The Predisposing Causes.*—(1) *Heredity.*—An inherited predisposition to the disease exists in from 50 to 60 per cent. of the cases. The disease is uncommon before the thirtieth year, although cases under twenty do occur, and infants at the breast have been known to have it. Heredity is a specially important factor in these early cases.

(2) *Sex and Race.*—Males predominate; only 2 out of 60 cases at the Johns Hopkins Hospital were in females. Although much more common in the white than in the colored race, the latter does not escape. Three of the 60 cases were in colored patients—one had tophi, and in the other two the clinical diagnosis was substantiated by the autopsy findings.

(3) *Food* is a very important factor. It is probably as much a matter of quantity as of quality. Overeating combined with insufficient exercise is particularly injurious. There is a "poor man's gout," in which poor food, bad hygienic surroundings, and the excessive use of malt liquors play an important part.

(4) *Alcohol* ranks with heredity as an etiologic factor. Fermented beverages, such as beer, ale, and wines, are much more injurious than distilled liquors, such as whisky and gin. Beebe, of Chittenden's laboratory, has shown that the injurious effect of alcohol is probably due to its inhibiting the action of a special ferment (uric acid oxidase) in the liver, which normally has the function of oxidizing and destroying uric acid. It apparently interferes only with the metabolism of the exogenous uric acid.

(5) *Lead* plays an important *rôle.* Garrod found that 30 per cent. of his hospital cases had been painters or plumbers. Lead probably acts injuriously by inducing arteriosclerosis and chronic nephritis, thus diminishing the ability of the kidneys to excrete uric acid.

2. *Exciting Causes.*—Severe shock, mental worry, and excessive physical fatigue are well known to often precipitate an acute attack in a gouty patient. A slight injury to a joint or a surgical operation may have the same effect.

3. *Chemical Causes.*—From a chemical standpoint the etiology of gout is closely connected with the metabolism of the purin bodies. These comprise uric acid, $H_2(C_5H_2N_4O_3)$, xanthin, $C_5H_5N_4O_2$, hypoxanthin, $C_5H_4N_4O$, guanin, $C_5H_5N_5O$, adenin, $C_5H_5N_5$. They are called the "purin" bodies because, as Emil Fischer has shown, it is possible to synthetically form them from a compound which has the formula $C_5H_4N_4$, to which he gave the name purin, and from the fact that each of these five bodies contains this group as a nucleus and can be derived from it by the process of oxidation. All five have been shown to originate in nucleic acid, which is derived from the nuclein contained in cell nuclei, and consequently the last four (xanthin, hypoxanthin, guanin, and adenin) are often known as the nuclein bases. They are also called the xanthin or alloxuric bases.

Of the purin bodies, uric acid concerns us most in the consideration of the etiology of gout. The theory that has long prevailed that gout is due to the effects of an excess of uric acid in the system still holds good today, notwithstanding attempts to discredit it. The investigations of the last few years have taught us much concerning the source of uric acid, and quite recent studies have revealed to us a great deal concerning the steps in its formation in the body under normal conditions. Burian and Schur were the first to use the terms "exogenous" and "endogenous" uric acid, now in common use, in referring to the source of the acid. Exogenous uric acid is derived from the purins or nuclein ingested with the food, whereas the endogenous uric acid is derived from the destruction of the body purins or nuclein. The work of Jones and his associates, Partridge and Winternitz, in this country, and of Schittenhelm, in Germany, have shown that specific organic ferments play a vital part in the various stages in the formation of uric acid. Thus, Jones has shown that there is a ferment *adenase* in the thymus, adrenals, pancreas, and liver, which hydrolyzes adenin into hypoxanthin. In practically the same glands there is another ferment, *guanase,* which hydrolyzes guanin into xanthin. Further, Schittenhelm has shown that the liver, lungs, spleen, and muscle contain another ferment which oxidizes xanthin into uric acid. Burian has called this ferment "*xanthin oxidase.*" Another important fact has been demonstrated, namely, the existence of a specific intracellular enzyme, appropriately called *nuclease,* which has the power of liberating the purin bases from their combinations as important parts of ingested or tissue nucleoproteids, or, more particularly, from their contained nucleic acid. Thus the purin bases, adenin, guanin, hypoxanthin, and xanthin, having been set free, the ferments *adenase*, *guanase*, and *xanthin oxidase* are enabled to act on them, and by hydrolysis and oxidation to convert them step by step into uric acid. Schittenhelm has also shown that there is another tissue oxidase present in the kidneys, liver, muscle, and possibly the bone-marrow, which has the power of further oxidizing uric acid and consequently destroying it. It is this ferment which is believed to be inhibited in its action by the ingested alcohol. It will thus be seen that there are four ferments—*nuclease*, *adenase*, *guanase*, and *xanthin oxidase*—which help to build up the uric acid, and another, a specific tissue *oxidase*, which oxidizes and destroys uric acid under normal conditions.

Burian claims to have recently shown that a considerable part of the endogenous uric acid in fasting individuals subjected to muscular exertion is derived from the purin base, hypoxanthin, which is constantly being formed as a metabolic product of living muscle tissue.

Uric acid is a dibasic acid, that is, it contains two atoms of replaceable hydrogen. It forms three groups of salts, which may be indicated as follows, "M" representing an atom of a monobasic metal, such as sodium, etc.: (1) *Neutral urates*, $M_2(C_5H_2N_4O_3)$, which is merely a laboratory compound. (2) *Acid urates* or *biurates*, $MH(C_5H_2N_4O_3)$. This occurs only under pathologic conditions in the human body, and is the form in which uric acid is deposited in tophi and in and about the joints. (3) *Quadriurates*, $MH(C_5H_2N_4O_2)$, $H_2(C_5H_2N_4O_3)$. This is a very loosely combined and easily soluble compound, and, according to Roberts, is the form in which uric acid normally circulates in the blood.

Normally, the blood contains minute quantities of uric acid. It does not circulate as free uric acid. It is not known with certainty in what form the acid actually exists in the blood. As stated, Roberts holds that it is as the very soluble quadriurate. This is disputed by many. Minkowski claims that it circulates in the blood in combination with the purin base, *nucleotin phosphoric acid*.

Pathogenesis and Pathology.—One of the few points concerning metabolism in gout upon which practically all investigators agree is that there is a marked excess of uric acid in the circulating blood. This can be demonstrated by Garrod's thread test, as well as by quantitative analyses. It is conceivable that this excess may take place in one of three ways: (1) By diminished oxidation; (2) by excessive formation; or (3) by diminished excretion of uric acid. The weight of opinion at the present day is in favor of diminished oxidation. The results of most investigators go to show that the excretion of uric acid in the urine in chronic gout is almost uniformly below the average for the normal individual (0.7 gram daily), and generally below the lower limits for normal (0.4 gram daily). In many instances the excretion is below 0.2 gram or even 0.1 gram daily. Just before an acute attack there is uniformly a marked diminution in the uric-acid excretion. Within two to three days after the onset of an acute attack the uric-acid output rises to normal or may temporarily be above normal.

With the subsidence of the acute symptoms it falls again below the lower limit for normal. This is thought to be brought about in one of two ways. One view is that the kidneys from either organic or functional changes are incapable of excreting uric acid. The other is that in gout the uric acid occurs in a combination different from that under normal conditions, and that it is consequently less soluble and more difficult for the kidneys to excrete, and accordingly is more readily precipitated in the tissues. The recent investigations demonstrating the important part that organic ferments play in the formation and destruction of uric acid suggest the possibility that deficient oxidation and destruction of uric acid may play a more important part in causing its increase in the blood than has previously been attributed to it. Beebe thinks that alcohol tends to produce gout by interfering with the special oxidase in the liver which is supposed to destroy the uric acid. The view that diminished alkalinity of the blood is responsible for the precipitation of the uric-acid salts in and about the joints and in the tissues in gout is no longer tenable. With more accurate methods in recent years it has been shown that there is no diminution in the alkalinity of the blood-serum in general, nor at the time when the biurates are being actively deposited about the joints during acute exacerbations.

Pathologically, gout manifests itself chiefly by changes in the articular structures. The acute attacks of arthritis are generally believed to be caused by a precipitation of the relatively insoluble sodium biurate in the articular cartilages and periarticular structures. This is commonest in the great-toe and tarsometatarsal joints. Eventually, many of the other joints, particularly those of the hands, become affected, and with repeated attacks great deformity may result. These periarticular tophi may ulcerate and discharge their "chalky" contents. Tophi often appear in the cartilages of the ear.

The metabolic disturbance eventually leads to a chronic interstitial nephritis, which very frequently leads to death from uremia. Arteriosclerosis is very common. Myocarditis with relative mitral insufficiency is a frequent complication in chronic cases, and pericarditis is not an uncommon terminal event. Emphysema is common.

The blood shows a marked excess of uric acid in some combination, the true nature of which is not yet known. The red cells, particularly in "lead gout," often show marked basophilic granulation.

TREATMENT

The first requisite in the treatment is a correct diagnosis. The writer has a strong conviction that many cases of true gouty arthritis are overlooked in this country and treated as rheumatism. Various factors contribute to this result. Failure to inquire into the character of the arthritic family history, the patient's habits and occupation, the situation and features of the initial arthritic attack, often lead to an incorrect diagnosis. It is necessary also not to be misled by the fact that in acute attacks gout is often a polyarticular affection, and that various joints in different parts of the body may be involved. The importance of examining the cartilages of the ears for tophi in every articular affection cannot be too strongly emphasized. The finding of a tophus, so often overlooked, with a demonstration microscopically of acicular crystals of sodium biurate in its contents, at once settles the diagnosis of an arthritic affection which may otherwise be obscure in origin.

Although certain general principles govern the treatment of gout, there is probably no affection in which it is so important to make a careful study of the special characteristics of each case and of the individual response to various lines of treatment. No two cases can be treated with best results along exactly the same lines. In no disease, therefore, is it so important to consider both the patient as well as the disease as in gout.

From what we know of the etiology of the disease, the consideration of its treatment falls more or less naturally under two headings: (1) The treatment of the disorder of metabolism causing gout; and (2) the treatment of the acute paroxysm and of other manifestations of the disease.

I. Treatment of the Disorder of Metabolism Causing Gout.—Although one or more of the other purin bodies (nuclein or xanthin bases) may subsequently be shown to play a part in the etiology of gout, according to our present conception the disease is due to an excess of uric acid in the circulating blood. As we have seen, the prevailing belief is that this excess is produced mainly by deficient oxidation rather than by excessive formation or diminished elimination of the acid. The rational treatment of the diathesis, therefore, would seem to be twofold: *first*, to restrict the production of uric acid in the system to the lowest possible limit; and, second, to increase its elimination as much as possible.

(*a*) *Measures to Resist the Production of Uric Acid in the System.—Hygienic and Prophylactic Treatment.*—In certain families there is an inherited tendency to the development of the disease in successive generations. This must be due to an inherited defect in normal metabolic processes. There is a greater tendency for the gouty manifestations in the members of these families to make their appearance at an early age than in acquired gout. By proper directions as to the manner of living, both hygienic and dietetic, the family physician can do something toward keeping the symptoms in abeyance and in mitigating their severity should they actually make their appearance. Instructions should be given to abstain from alcohol and to eat moderately. The character of the diet will be more fully described under the dietetic treatment. In both inherited and acquired gout the liability to an attack may be lessened by having the patient live an outdoor life, with plenty of exercise of a not too strenuous or fatiguing character, and by keeping regular hours. Moderate and systematic exercise is undoubtedly most beneficial. This is no doubt due to the fact that it tends to stimulate normal metabolic functions. Walking, golf, tennis, or horseback riding is to be encouraged. The exercise should always be within the limits of fatigue. Excessive physical fatigue is well known to often precipitate an attack, as has been demonstrated in soldiers subjected to forced marches. A possible explanation for this clinical fact is suggested by the recent observations of Burian, who showed that muscular exercise is followed by an increased elimination of uric acid in the urine, and inferentially by an increased formation of uric acid in the system, from the increased production of the purin base, hypoxanthin, which is constantly being formed as a metabolic product of living muscle tissue. The skin should be kept active by a cold morning bath, followed by thorough friction in robust patients or by the tepid bath in less sthenic cases. An occasional Turkish bath is beneficial. In patients subject to *podagra*, it is of the utmost importance that they should wear comfortable shoes, as there is no question but that a tight-fitting shoe may help to precipitate an attack of arthritis in the big-toe joint. Prolonged mental exertion and excessive worry are factors in producing an acute attack in persons subject to gout, and should, if possible, be avoided.

Dietetic Treatment.—Of the factors that control the formation of uric acid in the system, the food intake undoubtedly ranks first. We are confronted, however, with the most diverse views as to the sort of diet that should be given to a gouty patient. This diversity of opinion has especially to do with the quantity of proteids that may be permitted in the patient's dietary. A century ago Wollaston advocated the exclusion of meat and the prescribing of a strict vegetable diet. Haig is the most vigorous exponent of this régime at the present day. Von Mering and Pfeiffer think that there should be no restriction of the meats, and some of the English physicians, among them Armstrong and Wainwright, have gone to the extent of recommending the so-called "Salisbury," or exclusive red-meat, diet. Garrod, Cantani, Ebstein, and many others take an intermediate course, and advise the use of meats in moderate quantities. Sir William Roberts wrote that "the most trustworthy experiments indicate that fat, starch, and sugar have not the least direct influence on the production of uric acid; but as the free consumption of these articles naturally operates to restrict the intake of the nitrogenous food, their use has indirectly the effect of diminishing the average production of uric acid." Ebstein strongly advocates the use of large quantities of fat by the gouty patient. He recommends it in the form of good fresh butter in quantities of from 2½ to 3½ ounces (80 to 130 grams) daily. He claims that stout gouty patients do not increase in weight under such a diet, but that they actually lose weight, and that there is a general improvement in the patient's condition. Concerning the use of carbohydrates, W. H. Draper says: "The conversion (oxidation) of azotized (proteid) food is more complete with a minimum of carbohydrates than it is with an excess of them; in other words, the best means of avoiding the accumulation of lithic (uric) acid in the blood is to diminish the carbohydrates rather than the azotized foods." Cantani also advises the exclusion of the carbohydrates and fats owing to the fact that they are so easily oxidized. As a result the proteids are, as it were, protected and not completely converted into their end-products, chiefly urea; and thus an excess of uric acid results. This view is based on a misconception of the source of uric acid.

Proteids.—Although we are confronted with this great diversity of opinion as to the proper diet in gout, the majority of the authorities have recommended a definite restriction of the meats. While there is a certain rational basis for this advice, it has, in part, been founded on a misconception. It was for a long time supposed that uric acid constituted an intermediate stage in the conversion of the proteids of the food into urea. We now know that the exogenous uric acid, that is, that formed from the ingested food, is derived from the purins or nucleins; in other words, from a special form of proteid, the nucleoproteids. It will naturally be inferred that those forms of animal food rich in cellular elements, and consequently in cell nuclei, such as sweetbreads, liver, kidneys, and brain, will be those that will cause the greatest formation and output of uric acid. In general terms this is true, and these articles should be excluded from the diet. The administration of meats to a healthy as well as to a gouty individual causes an increase both in the uric acid and in the urea, but the increase in the former is relatively not nearly so great as in the latter. The increase in the uric acid is due to the purin content of the food rather than to the ordinary proteids. The red meats have been considered more injurious than the white, owing to the belief that they are richer in extractives (purin or nuclein bases). Actual feeding experiments by Kaufmann and Mohr in recent years have shown, however, that there is not a greater increase in the uric-acid excretion when the individual is on a red-meat diet over that when he is given a white-meat diet. The white meat is, on the whole, preferable, owing to its being more easily digested, and also owing to the fact that the red meats, particularly those of game, are usually accompaniments of a highly seasoned, rich dietary, which should be avoided by the patient. Meats prepared by boiling or stewing are preferable to raw or roasted meats. In the case of the former, some of the extractives (purins) are removed by the process of boiling. Broiled fish is permissible in moderate quantities.

Soups prepared from meats and beef-extracts, although on first thought they would seem to be indicated, should be avoided, owing to their richness in extractives—the purin bases. Strauss and Eitner showed that the administration of 50 grams of Liebig's beef-extract increased the output of uric acid from 1½ to 2 times.

Eggs, being free from nucleins, cause no increase in the excretion of uric acid, even when given to the number of twenty-four daily, as has been shown by Hess and Schmoll. They may, therefore, be permitted a gouty patient in unlimited numbers, and constitute a good substitute for meats.

Milk and *cream*, owing to their being purin-free and highly nutritious, are most useful as a part of the patient's dietary, particularly during an acute exacerbation. *Cheese*, although containing considerable proteid, is free from nucleoproteids and is permissible in moderate amounts.

Carbohydrates, Including Vegetables.—In general terms it may be said that most carbohydrate foods are permissible in most any quantity. The patient should be rather encouraged to eat freely of vegetable food, as in this way the proteids can in part be cut down. The green vegetables, such as lettuce, spinach, and cauliflower, are particularly to be recommended. Tomatoes and cucumbers, owing to their supposed high acidity, should be avoided. It has been the custom of some authorities, particularly Haig, to recommend an almost exclusive vegetable diet. The present tendency, however, is against this extreme. An argument in favor of a vegetable and carbohydrate diet is the circumstance that in the countries in which the dietary is composed largely of carbohydrates, such as Japan, gout is said to be exceedingly rare. Such a diet also yields fewer waste-products to be eliminated by the kidneys, whose function, as is well known, is materially impaired in gout.

Fats.—These are permitted to the extent the patient desires them. As already stated, Ebstein recommends fat in the form of butter in large quantities. The danger of upsetting digestion by too free a use of fat must be guarded against, however.

Spices and Salt.—Highly seasoned foods of all kinds should be avoided. Thus the free use of pepper, mustard, etc., should be prohibited not only for the reason that they are likely to disturb digestion, but also because they tend to increase the appetite, both of which results we desire to avoid. Sir William Roberts strongly advocated the cutting down of salt in the food to the lowest possible limit. He claims that its use tends to favor the deposition of sodium biurate in the tissues. It is a noteworthy fact that the biurate deposits are most abundant about the joints in the neighborhood of the synovial fluid, which is rich in sodium chlorid.

Fruit.—The early teaching was that fruits should be avoided, owing to their supposed acidity. At the present day, however, they are recommended by most authorities, owing to the fact that the organic acids which they contain are oxidized in the system into carbonic acid, thus forming alkaline carbonates which aid in keeping the uric-acid combinations in solution in the blood. On the one hand, we are told that such acid fruits as strawberries, grapes, cherries, and lemons should be avoided; on the other hand, we have the various cures attributed to each one of these. Klemperer speaks highly of the lemon cure, in which he recommends the administration of the juice of four or five lemons daily with Vichy water. In general, it may be said that fruit is advantageous rather than otherwise. The physician must be governed by the effect in each individual patient. For instance, Tyson states that one of his gout patients could precipitate an acute attack by drinking a single glass of lemonade, whereas another could drink a pitcherful without any bad effect whatever. Personally, I have observed a patient subject to gouty manifestations who invariably had an attack of pharyngitis and laryngitis when only a few strawberries were eaten.

Alcohol, Tea, and Coffee.—The gouty patient should abstain from alcohol. There are but few occasions when an alcoholic stimulant is indicated, and when it is, it is best to give it in the form of whisky, as distilled liquors are much less potent in predisposing to gout or inducing an acute exacerbation than are the malt liquors. A satisfactory explanation why the fermented beverages are the more injurious has never been advanced. It has been held that the difference is due to the malted liquors containing more acid, sugar, and salt. This explanation does not seem ample, however. The injurious effect of alcohol in general is probably due to its diminishing oxidation in the liver. As a result, the action of the special ferment (oxidase) in the liver, whose function it is to destroy uric acid, is interfered with, and uric acid consequently accumulates in the blood. This explanation has been advanced by Chittenden and Beebe. The effect of alcohol in gout is well illustrated in many patients, in whom a single glass of beer or wine will cause twinges of pain in one or more joints, or even precipitate an acute attack. In Germany there is an inclination to be less rigid as to the restrictions in the use of alcohol and to permit the lighter Moselle wines in moderate quantities.

Some have recommended the complete cutting off of tea, coffee, and cocoa, owing to the contained purin derivatives—thein, caffein, adenin, theobromin, and theophyllin. So far as their effect on the output of uric acid is concerned, there is no valid reason for cutting them off from the patient, for it is found that these purins are either eliminated unchanged or converted into heteroxanthin, but no portion into uric acid. Gout patients should be cautioned against the excessive use of these beverages, owing to their injurious effect on the digestion, nervous system, and heart. By permitting their use in moderation, however, it will be found easier in certain cases to cut off the alcohol.

Diet in the Acute Attack.—During an acute exacerbation the diet should be absolutely purin-free. Such a diet may be chosen from the following articles, none of which contain any nucleins or nucleoproteids —milk, eggs, junket, custards, oatmeal with cream, rice, bread and butter. For the first day or two the patient should be restricted to milk, then one or more of the other articles may be added. With the subsidence of the acute features the diet may be enlarged and small quantities of white meat, such as the breast of chicken, allowed.

Summary of Dietetic Treatment.—The best authorities at the present day advise a modified nitrogenous diet, without an excess of fats or carbohydrates. The proteids, particularly the nucleoproteids, should be materially reduced, but not entirely cut off. Red butcher's meat and the red meat of game should be avoided. The white meat of poultry, eggs, and fresh fish are permissible in moderation. In the regulation of the diet it is as much a question of quantity as of quality. Overeating with insufficient exercise is the great evil to contend against. The great tendency, as persons progress in years, is for them to eat more than the system requires, and to become more sedentary in their habits. The physician must vigorously fight these two tendencies in the treatment of his gout cases. With the partial cutting-off of the proteids the amount of vegetables may be moderately increased. It is better to eliminate alcohol entirely. The patient in most cases will pay the penalty of any infringement of this rule. During an acute attack the diet should be absolutely purin-free.

(*b*) *Measures Designed to Increase the Solubility of the Uric Acid Compounds and to Facilitate their Elimination from the System.—Water.* —First and last under this category must be mentioned water. For decades attempts have been made by chemists to find an ideal uric-acid solvent, one which will not only keep the uric-acid compounds in solution in the blood-serum, but will also dissolve the biurates that have been deposited in the tissues, and thus facilitate their elimination in the urine. Notwithstanding the claims to the contrary, no such solvent has been found that has stood the test of practical experience. Any solvent action that these preparations may possess is due rather to the water with which they are given, *e. g.*, piperazin water, than to any inherent virtue of the drug itself. Experience having taught us this, we must instruct our patients to drink freely of water, to the extent of two to three liters (quarts) daily. It is often difficult to get patients to drink pure water alone. They are more willing to drink the waters of certain springs that are put on the market. This is the main justification for prescribing these various waters, which entails considerable expense to the patient.

Alkalis.—It is customary to administer alkalis to gout patients, particularly during the acute exacerbations. Their use has come into vogue owing to the theory first advanced by Garrod, that uric-acid depositions result in part from a diminished alkalinity of the blood-serum. This view is probably erroneous, for quantitative determinations with more accurate methods have failed to show that the blood-serum in gout at any phase of the disease is less alkaline than normal. It was thought that, by the administration of alkalis, it would be possible to increase the alkalinity of the blood and thus enable it to hold the uric-acid combinations in solution. As Minkowski and others point out, it is very doubtful whether the blood alkalinity can be increased when alkalis are administered by mouth, even in large amounts. If given, the alkaline carbonates should be chosen. There has been considerable controversy as to whether the sodium or potassium salts should be administered. The sodium salts are recommended by some, owing to the belief that they can be given in larger quantities than the potassium salts without disturbing digestion. On the other hand, Luff and others advocate the potassium salts, owing to the belief that they are more powerful uric-acid solvents.

My own custom is to administer potassium bicarbonate or potassium acetate in 20- to 30-grain doses every four hours in a full tumbler of water until the urine is alkaline, and then sufficient to keep it alkaline. This is begun during the acute attack, and continued at least until the acute manifestations subside. In the intervals it is well to place the patient periodically on moderate doses of the alkali, combined with 5 or 10 grains of potassium iodid three times daily. A popular form in which to administer alkalis is as lithium carbonate, in 5 or 10 grains three or four times daily. This treatment was first instituted by Garrod, owing to the belief that the urate of lithium formed was much more soluble than any other uric-acid salt. The effervescing tablets of lithium carbonate are now generally prescribed. Whether alkalis increase the alkalinity of the blood-serum or not the writer has no practical experience, but it is undoubtedly possible to render the urine alkaline. It is difficult to see how this can be done without changing the reaction of the blood-serum. Any beneficial effect resulting from the use of alkalis is probably in large part due to the increased amount of water taken by the patient. By their use it is possible to induce the patient to take more water than he otherwise would.

Mineral Waters and Spa Treatment.—Regarding the inherent virtues of the various mineral waters the writer is extremely skeptical. As Osler well puts it: "Much of the humbuggery in the profession still lingers about mineral waters, more especially about the so-called lithia waters." The waters undoubtedly do good in many cases, but we must be honest and acknowledge the fairly well-established fact that the beneficial effect is in a large measure due to the action of the large quantities of H_2O taken by those undergoing a cure, rather than to the contained mineral ingredients. Granting that this be true, we might expect that the mineral waters taken at home would give as good results as when taken in the course of a cure at a particular spa. This, however, is not the case. Many factors other than drinking the waters contribute toward the undoubted benefit often obtained as the result of a course of treatment at a mineral spring. These consist of regular hours; a fairly rigid dietetic régime; systematic exercise in the way of walking, etc.; pleasant surroundings; and, not the least important of all, freedom from worry and business cares. The patient devotes his whole time to the restoration of his health, which he does not do when he remains at home. It is well, therefore, for those victims of gout who can afford it to take a cure at one of the spas once a year. Where a suitable mineral spring is easily accessible, it is well to send a patient there to spend the period of convalescence from an acute attack. Judgment must be exercised in the selection of cases. It is better to spare gout cases with myocarditis and severe chronic nephritis the fatigue and risk occasioned by a long journey to a watering-place. Too frequently in these cases such trips terminate in tragedies.

Of the five chief varieties of mineral waters, viz., the alkaline, saline, alkaline-saline, purgative, and sulphurous, the alkaline and alkaline-saline are those that seem to have earned the best reputation in the treatment of gout, although those possessing purgative qualities also enjoy a good repute. The mineral springs to be recommended are those of which sodium bicarbonate is the chief ingredient, to which calcium bicarbonate is considered a valuable adjuvant. These comprise the alkaline waters of Vals, Vichy, and Contrexéville in France, Evian-les-Bains in Switzerland, Neuenahr, and Fachingen in Germany. Other waters contain less of the alkaline bicarbonates, but owe their reputation to their combined alkaline and aperient qualities from the sodium sulphate they contain. These include Carlsbad and Marienbad in Bohemia. Of the saline waters with established reputations in the treatment of gout there are those of Baden-Baden, Homburg, Kissingen, Wiesbaden, and Saratoga Springs in this country. The waters of Bedford Springs, Pa., possessing mild aperient properties, may be recommended. For those who can afford these waters they may be prescribed in the intervals, with fair prospects of diminishing the liability to acute attacks.

At certain springs the waters are warm and have the additional advantage of being used for bathing purposes. These include, among others, Baden-Baden, Ems, Wiesbaden, and Dax in France.

Various sulphurous waters possess a certain reputation in the treatment of gout cases, particularly those with skin complications. Among these are Aix-la-Chapelle in Prussia, Aix-les-Bains in Savoy, Harrogate in England, Richfield Springs, Sharon, and Mt. Clemens in this country, and St. Catherine's in Canada.

Uric-acid Solvents.—As has already been stated, these preparations have not borne out the claims made for them when they were first introduced into the therapy of gout. This has resulted from the false conception that the preparations would dissolve uric acid in the system in the same way they would in a test-tube in the laboratory.

For a number of years certain organic, nitrogen-containing bases belonging to the diamins possessed a considerable reputation. These included *piperazin* (diethylendiamin), *lycetol* (dipropylendiamin), and *lysidin*, another diamin. It is a useless expense to prescribe these preparations.

Urotropin (hexamethylentetramin), first introduced by Nicolaier, possessed a high reputation for a number of years as a uric-acid solvent. In the organism urotropin yields formaldehyd. A small part of this formaldehyd is eliminated in the urine in combination with uric acid as diformaldehyd urate, which is said to be very soluble. At first it was thought that urotropin would be of great service in dissolving uric-acid calculi in the kidneys. Such has not proved to be the case, however. Quantitative determinations of the uric acid after urotropin administration show practically no increase in its output. As a uric-acid solvent the drug is now but little used. As a urinary disinfectant it possesses undoubted value.

Intestinal Eliminants.—There is no definite proof that the administration of laxatives or purgatives increases the output of uric acid by way of the intestinal tract. It is important, however, to keep the bowels moving freely. For this purpose the salines, such as sodium sulphate, sodium phosphate, magnesium sulphate, Hunyadi water, and Carlsbad salts, are most serviceable.

II. Treatment of the Acute Paroxysm and Other Manifestations of the Disease.—Management of Acute Attack.—*Local.*—The joints should have absolute rest and, where possible, should be elevated. Warm fomentations usually give a good deal of comfort. Warm compresses kept moist with solutions containing opium give considerable relief. For this purpose lead and opium lotion or Fuller's lotion (carbonate of soda, 6 drams; laudanum, 1 ounce; glycerin, 2 ounces; and water, to make 9 ounces) may be used. The hot-air treatment sometimes gives relief. With the acute symptoms gentle massage may be started.

Dietetic.—During the acute attack the food should be purin-free, as indicated in the section on Diet.

Medicinal.—In some cases the pain is so severe that it is necessary to resort at once to morphin, up to ¼-grain doses hypodermatically. This should be used only when absolutely necessary. A brisk saline purge should be administered at the onset.

Colchicum is the drug which general experience has shown to give greatest relief in the acute attack. It is usually very prompt in relieving the severe pain. Its mode of action is not definitely established, but it probably exerts its beneficial effect through its action as a cholagog, as Rutherford has shown. The wine of colchicum is the preparation generally prescribed. In this country the wine of the seeds is no longer official, so that the wine of the root is the preparation dispensed. It has been claimed by some that to secure the best results colchicum should be given in doses sufficiently large to produce purgation. Others hold that this is not necessary. The dose of the wine of the root is from 15 to 30 minims (1 to 2 c.c.). My custom is to start with 20-minim doses every two hours for eight or ten doses. If it is going to have the desired effect in reducing the pain, it will usually do so by the end of such a course. After that I generally continue it in 20-minim doses every four hours for three or four days. *Colchicin* in $\frac{1}{50}$-grain (0.0013 gm.) doses may be used as a substitute by mouth or hypodermatically. A favorite recent remedy is *salicylate of colchicin*, in doses of 5 minims (0.33 c.c.), given in capsules or perles at the same intervals as the wine.

Salicylate of sodium may also be tried for the relief of the pain, and is even preferred to colchicum by Tyson and others. It should be given in 15-grain (1 gm.) doses every two hours at first, and the dose reduced with the relief of the pain. Bohland, Herter and Smith, Schreiber and Waldvogel found that salicylates increase the output of the uric acid. *Aspirin* (acetyl-salicylic acid) may be used as a substitute in the same sized doses. In my own personal experience the salicylates are not so prompt in relieving the pain as in rheumatism, nor are they as effectual as colchicum.

In case the above remedies fail to relieve the pain, some of the other analgesics may be tried.

Treatment of the Complications of Gout.—*Retrocedent or Suppressed Gout.*—Coincident with the disappearance or improvement of the local symptoms, remarkable internal manifestations may occur. These consist of pain, vomiting, diarrhea, and great depression, and death may occur during the attack. There may be delirium, coma, or even apoplexy. Uremia is undoubtedly responsible for some of these features. The treatment is, on the whole, unsatisfactory. The condition must be relieved symptomatically, and efforts may be made to induce a true external attack by hot mustard foot-baths and sinapisms. As champagne is the wine most frequently responsible for an acute attack, it has even been suggested to give the patient a pint of this beverage.

Arteriosclerosis and Myocarditis.—The usual measures prescribed in these conditions are applicable here. For the headaches and high pulse tension of arteriosclerosis the nitrites are indicated and often give prompt relief.

Gouty myocarditis is a serious condition, and is not infrequently the cause of death. Digitalis, strophanthus, etc., should be prescribed. I wish to emphasize my personal belief that more injury than good results from ordering gout cases with serious myocardial disease to Nauheim and such places for the bath treatment. Any good resulting from the baths—and benefit does not invariably result—is more than offset by the injury occasioned by the fatigue of a long journey.

Chronic Nephritis and Uremia.—Uremia from contracted kidneys is the commonest cause of death in gout. The dietetic treatment in cases with advanced renal degeneration is most important, and in these cases a further restriction—or even a complete exclusion—of the proteids is indicated. The other usual remedies are here applicable.

Gouty Glycosuria.—Fortunately, the glycosuria in gout is of a mild type, and may last for years without increasing in severity, and usually no symptoms directly referable to the glycosuria are suffered from. It is usually readily amenable to dietetic treatment. A complete and, as a rule, a partial restriction of the carbohydrates almost invariably clears up the glycosuria. Patients with this complication should be instructed to materially restrict their carbohydrates.

Treatment of Irregular Gout.—The term *irregular gout* is applied to a motley, ill-defined group of symptoms occurring in members of gouty families, but in whom the true articular features have never manifested themselves. The victims have usually lived not wisely, but too well, and have eaten and drunk largely and have lived sedentary lives. Many of these symptoms require no special treatment, and are likely to be relieved by having the patient follow the dietetic and hygienic treatment already outlined.

For the *cutaneous eruptions*,—the *arthritides* of the French,—which usually take the form of an eczema, the sulphur baths and the sulphur waters internally are indicated. The nature of the local treatment will depend upon the exact character of the skin lesion.

Gastro-intestinal disorders are common. For the dyspepsia, so-called torpid liver, and constipation, the saline aperients are indicated. Hunyadi water, the Carlsbad salts, or sodium phosphate should be prescribed. The proper regulation of the diet is of utmost importance.

Gouty persons are prone to uric-acid *calculi*, Jerome Cardan to the contrary notwithstanding. We have no satisfactory medicinal uric-acid solvent. The patient should drink very freely of water or of some good alkaline mineral water. The urine should be kept alkaline by the administration of potassium bicarbonate or potassium acetate.

Of the *nervous features*, headache and migraine attacks are the most frequent. Haig insists on the cutting off of the proteid food in these cases. If the pulse tension be high, the nitrites should be given. Severe cramps in the extremities and even in the thoracic and abdominal muscles are often very annoying. Massage and the administration of moderate doses of potassium iodid may give some relief to this symptom.

LITHEMIA. URIC-ACID DIATHESIS

By Thomas B. Futcher, M.B.

The terms *lithemia* and *uric-acid diathesis* are usually applied to a group of ill-defined, obscure symptoms for which the physician can find no satisfactory cause. The diagnosis is more apt to be made if a deposit of uric-acid crystals happens to be found in the urine. These two supposed conditions constitute a "scrap-basket" into which the practitioner is only too willing to cast a group of symptoms for which he can find no obvious cause. It is usually merely an admission on our part that we do not know what is wrong with our patient. The symptoms usually covered by the two terms are supposed to be due to an excess of uric acid in the circulating blood. There seems no scientific basis for this opinion—one based on quantitative determinations. A diagnosis of uric-acid diathesis, based on the finding of macroscopic urates and uric-acid crystals in the urinary sediment, coincident with the appearance of the symptoms, is poorly founded. The appearance of a uric-acid sediment in the urine does not necessarily mean that there is an excess of the acid in the blood, for the power of the urine to hold uric acid in solution depends upon several factors, viz., the amount of water taken, the amount of the urinary pigments, and the percentage of the various salts of the urine. For these reasons the amount of uric acid in the urine may actually be below normal for the twenty-four hours, and yet be precipitated as a sediment. The precipitation is very often due to the fact that, with the onset of the particular group of symptoms complained of, the patient drinks much less fluid than ordinarily, thus rendering the urine less capable of holding the uric acid in solution. There are certain health resorts in this country to which neurasthenics and others with various vague aches and pains go for treatment, and these are almost invariably told that "their blood is full of uric acid." They rather like to be told this. They are pleased to be able to say that their symptoms are due to an excess of uric acid in the blood. In the majority of these cases there is no apparent justification for the diagnosis, and it is very difficult to disabuse the patient's mind of this idea.

It is the desire of the writer to help to discourage the all too prevalent use of the terms lithemia and uric-acid diathesis. It is better not to make such a diagnosis unless the particular symptom or group of symptoms occurs in a member of a family in which undoubted articular gout is well known to occur. The symptoms considered in the previous section under the treatment of irregular gout may, with a certain degree of justification, be regarded as manifestations of a uric-acid diathesis.

When the physician is inclined to make a diagnosis of a uric-acid diathesis as the probable cause of obscure symptoms in a member of a family in which true gout is not known to exist, it is best for him to treat the condition symptomatically, to insist on the patient drinking plenty of water,—this can do no harm,—and to convince himself as soon as possible that his diagnosis is wrong, and to look about for the true cause of the symptoms complained of.

CHRONIC ARTICULAR RHEUMATISM

By Thomas B. Futcher, M.B.

This name is almost universally applied by text-books to an affection of the joints characterized by pain, stiffness, and considerable thickening and deformity, and believed to result from previous attacks of acute or subacute articular rheumatism.

The affection is stated to occur usually in middle-aged persons of the poorer classes, and is said to be commonest in washerwomen and day laborers, and those whose occupations expose them to cold and damp.

The writer is strongly convinced that there is no such disease as chronic articular rheumatism. He has seen many cases diagnosed as such, however, but he has yet to see an undoubted case of chronic articular rheumatism that has followed one or more undoubted attacks of either acute or subacute articular rheumatism. Acute articular rheumatism is not a disease which leads to permanent disability or deformity of the joints. There is practically complete restoration of the function of the affected joints after even repeated attacks of acute or subacute rheumatic fever, and no thickening or deformity occurs.

The more the writer sees of joint affections, the more firmly convinced he is that the diagnosis of chronic articular rheumatism should be abandoned. This also seems to be the opinion of nearly every one who is specially studying joint affections at the present day. When a physician treats a patient for chronic articular rheumatism, he practically convicts himself of having made a wrong diagnosis.

The diseases that are most often mistaken for chronic articular rheumatism in their order of frequency are: arthritis deformans, gout, gonorrheal arthritis, neuritis, and movable sacro-iliac synchondrosis. There is little doubt but that 85 to 90 per cent. of the disabled and deformed joints diagnosed as chronic articular rheumatism are really cases of arthritis deformans, the most of the remainder being gout cases.

Rather than to have described the treatment of a disease which he holds does not exist, the writer feels that he will have accomplished more by having pointed out the affections that are oftenest mistaken for the so-called chronic articular rheumatism. When the practitioner meets with a case which he has heretofore been accustomed to call chronic articular rheumatism, he should, by a careful study of the history of the affection and of the character of the deformity, decide which of the above diseases the condition most probably is, and treat it accordingly.

SURGICAL TREATMENT OF ARTHRITIS DEFORMANS

By Joel E. Goldthwait, M.D.

Arthritis deformans is here used as a general term, and includes the various types of rheumatoid disease, which are described more in detail by Thomas B. Futcher in this volume.

CHRONIC VILLOUS ARTHRITIS ("DRY JOINT")

Inasmuch as the symptoms in this type of disease are due largely to the relaxed folds of membrane or to the villi which form as the result of continued irritation within the joint, the surgical treatment consists in the protection of the joint, with the idea of lessening the irritation which would naturally result in use or in the removal of these fringes, either by absorption from pressure or by operation.

Non-operative Treatment.—This has for its purpose the lessening of the irritation within the joint which would result from use, and at the same time the reduction in the size of the fringes, so that the irritation will not recur as soon as the protection is removed.

The first part, or the lessening of the irritation, which would result from use of the joint, is accomplished by the limitation of the joint action, and the extent to which this is carried, whether slight protection or complete immobilization, will depend upon the degree of severity in the individual case.

In the severe cases in which use is attended with much pain or in which the joint is swollen, as is frequently seen, owing to the internal trauma which the pinching or the irritation of the fringes causes, the joint should be completely immobilized. If this is necessary, a plaster-of-Paris bandage is probably the most readily adaptable, although any apparatus which controls the joint motion may be used. In the knee, which is the joint most commonly affected, the bandage should extend from the ankle to the groin. In the majority of cases, however, complete fixation is not necessary, and the irritation can be controlled sufficiently by the use of less rigid supports. Flannel bandages of generous length or gauze bandages applied over layers of sheet-wadding, from the mere bulk as well as the compression, limit the motion and necessarily lessen the irritation. Such a dressing can be made still more rigid, should that be desired, by incorporating in it strips of heavy felting or pasteboard. In the case of much pain and sensitiveness not infrequently much relief is obtained by having the patient wear a layer of rubber dam over the joint under the flannel bandage or the compression dressing. This not only serves to make better fixation, but the effect which such an application has upon the circulation, of which the local perspiration is a sign, is undoubtedly of benefit. The warmth of such a dressing, as is true of many of the heat applications, tends to relax the muscular spasm which is commonly seen in any joint irritation, and by so doing gives some relief. After the acute swelling and sensitiveness have passed and more freedom of use is desired, strapping of the joint with adhesive plaster is of considerable value. This, in the knee, is of particular advantage. The dressing consists of strips of adhesive plaster about one inch wide, applied "crisscross" from just below the tubercle of the tibia to a little above the patella. The strips should extend from the biceps tendon on the outer side to a similar point on the inner side of the leg, and should be drawn as tight as possible. In such a dressing, since it does not surround the leg, the posterior tendons are not interfered with and the circulation in the lower leg is not disturbed.

In connection with the protection of the joint, everything that is possible should be done to relieve strain or other influences that may have been factors in the development of the trouble, and at the same time every effort should be made to improve the circulation and the general tone of the part affected. In the joints of the lower extremities the strains resulting from weakening of the arch of the foot are by far the most common, and whether the joint affected be the hip, the knee, or the joints or the feet themselves, if the arch is abnormally low, it should be restored.

For the increase of the tone of the part massage of the muscular groups above and below the affected joint, together with light massage of the joint itself, is of value. Heat is also of value, both for the effect upon the circulation and for the relaxation of the contracted muscles, and may be applied in many ways, such as hot fomentations, hot air, the so-called baking process, hot sand, or salt bags, etc. The stimulating bathing, such as the alternating hot and cold showers, is of assistance in increasing the strength, and so also is electricity if regularly used.

Operative Treatment.—At times conservative measures fail to give more than temporary relief, and because of the size of the villi or their location the joint action is seriously interfered with. In these cases, unless it is decided to use fixation appliances for indefinite periods, the villi should be removed by operation.

In the knee, which is the joint most commonly requiring such treatment, the operation consists of a longitudinal incision at the inside or the outside of the patella, long enough to expose the joint for thorough exploration. If the incision upon one side of the patella does not satisfactorily expose the joint, a similar incision should be made upon the other side. Through these the entire joint can be examined.

The villi are most commonly seen below the patella, under the patellar tendon, or along the edge of the articular surface of the femur, these having been formed in part by the membrane being drawn into the articulation by the movements of the patella. If the villi have existed for any length of time, fatty degeneration results, and instead of loose tabs, not infrequently masses of fat covered with a thin layer of synovial membrane are present. These latter are formed near to the articulation, and so loosely attached that they can be drawn into it during action, and should be removed, as should be the tabs or distinct villi, in case they exist.

After the removal of the villi, the bleeding should be controlled by compression or by flushing the joint with hot water, and the wound tightly closed. In this it has been my custom to use a buried suture to close the wound in the synovial membrane and the capsule, the skin wound being closed separately. Over this is applied a large gauze dressing held in place by a snugly applied bandage. No splints are used, as the moderate amount of motion which would result with such a dressing, with the patient in bed, is considered an advantage by reducing the danger of adhesions. The first dressing should be changed at the end of a week, after which a lighter bandage is used, this being removed each day for passive motion and stimulating bathing. At the end of two weeks the patient should be allowed to walk about, the bandage being continued for one or two weeks longer for light protection.

Following such operations, as the condition for which the operation was performed is purely mechanical, the joint function should be normal unless there has been some complication.

In the other joints, while the incisions may be different, the principles of treatment are the same.

ATROPHIC ARTHRITIS (RHEUMATOID ARTHRITIS)

The surgical treatment of this type of joint disease, the essential pathologic feature of which is a gradually developing and progressive atrophy of the joint structures, consists chiefly in the protection of the joint during the active stage of the disease, so that in the ultimate result the function may be impaired as little as possible.

Because of the nature of the pathology, it is naturally desirable to keep up the use of the affected joint as much as possible during the entire course of the disease, since by so doing the circulation is necessarily more free and the nutrition of the part consequently less impaired. The complete immobilization of the joint, which would be indicated in some of the other types of joint disease, is not desirable in this type, and only such limitation of function should be allowed as would be necessary to control the joint irritation. For this, bandaging is usually sufficient, entirely without the use of splints. If the joint is much swollen, the bandaging should be applied with compression in order to favor the absorption of the fluid. If, after a reasonable period of compression, the fluid in the joint is not materially less, aspiration is justifiable, as prolonged distention of the capsule tends to atrophy and consequent weakening of the joint. If aspiration is to be performed, full surgical precautions should be taken in order to prevent the possibility of sepsis. Occasionally after the fluid has been drawn off in this way the swelling recurs as the joint is used. This is usually due to the fact that villi or synovial fringes have formed in connection with swelling of the membranes, and that the irritation which is occasioned by the catching of these fringes is sufficient to produce an internal trauma and cause the swelling. At other times the fibrin in the fluid is precipitated, and masses of this coagulated fibrin act also as irritants. If it can be clearly demonstrated that either of these conditions is present, the joint should be opened and the fringes or the coagula removed. The operation in its detail is similar to that described under Chronic Villous Arthritis.

Not infrequently during the stage of swelling vicious attitudes are assumed, which, if preserved, lead to undesirable deformities later. In the knee flexion, with varying degrees of subluxation, is frequently seen, and in the other joints deformities of like character are met with. The fact that such deformities do occur should be borne in mind and proper measures taken to prevent them. For this, splints should be used in order to overcome contractures which may have taken place, and by means of massage and manipulation the muscles, tendons, and ligaments should be kept in as near the normal tone as is possible. If splints are to be used, they should not be worn more than a few hours at a time, during which period the contracted tissues are stretched. The remainder of the time the part should be kept at as nearly the normal function as is possible.

If contractures or adhesions have taken place, these should be overcome by manipulation under an anesthetic, after which the return to function should be as prompt as possible, in order to stimulate the circulation and consequently improve the nutrition.

In the extreme cases at times, in spite of reasonable care, the bone atrophy is marked, and in the repair true ankylosis results. When this seems evident, the position of the bones should be considered, so that when the ankylosis has taken place, the use of the part may not be unnecessarily impaired or the deformity unnecessarily conspicuous.

During the entire course of the disease it is to be remembered that since the pathology represents a progressively developing atrophy, measures should be continually employed which would tend to improve the nutrition of the part, and consequently lessen the amount of atrophy which would otherwise develop. For this purpose the stimulating forms of bathing, massage, electricity, hot air (the baking process), etc., all are of importance, but if they are to be of any real use, they must be continued during the entire course of the disease, and the best results are undoubtedly obtained by frequently alternating with these measures.

HYPERTROPHIC ARTHRITIS (OSTEO-ARTHRITIS)

The important pathologic feature of this type of joint disease is a hypertrophy of the cartilage at the edge of the articulations, with the ultimate ossification of this hypertrophied tissue, and with this there occasionally is a similar bone hypertrophy at the attachment of the ligaments or tendons.

Many of the symptoms are due to the presence of this hypertrophied tissue acting as a mechanical irritant within the joint.

Such being the case, the essential feature in the surgical treatment of this type of disease is the protection of the joint in order to lessen the irritation. The degree of protection should depend naturally upon the extent of the disease and the acuteness of the symptoms. At times complete fixation is necessary, while at other times slight protection with a soft bandage may be sufficient, and between these two extremes the degree of protection may vary considerably. The amount of support required in a given case can usually be determined by the amount of pain, the support being applied in sufficient amount to control this pain.

Use of the joint without pain is to be encouraged, as the strength and nutrition of the joint are preserved by such use. On the other hand, use which is associated with pain should be avoided, since the pain is an indication of irritation, which, if continued, would result in an extension of the disease.

In the finger-joints, which are very commonly involved, especially the distal row, showing as Heberden's nodes, the general advice should be given to avoid, in so far as possible, use which is painful, and while this in many cases may seem to be impossible, the lessened irritation which results from considerate use, even in those whose lives are active, is sufficient to be of real importance in preventing the extension of the disease. A convenient form of splint, in case such should be desirable, is made by having light strips of steel attached to the flexor side of the fingers of a loose fitting glove. This prevents the use of the finger-joints, but at the same time allows considerable use of the hands. Such splints can be worn at night and as much of the daytime as is possible.

For the wrist or elbow, any form of splint which controls its action is of value. In the shoulder, if the process is at all acute, the arm should be fixed to the side by means of a body bandage or a double sling, if the patient is to be allowed up, while for the night, or when lying down, the same dressing can be used, or the arm simply placed upon a pillow, which, by supporting the elbow and forearm, prevents the drag upon the anterior ligaments, which is the cause of much of the pain.

In the foot the process is commonly seen about the great toe-joint, at the upper edge of the scaphoid, or at the attachment of the Achilles tendon and the plantar fascia. For protection of these parts firm bandages, at times stiffened with strips of felt or splint material, are of much service, while the strain from weight-bearing is lessened by the use of crutches or by means of properly adjusted foot-plates.

In the knee the nodes which form in the thickened cartilage and bone along the edge of the femoral cartilage and the edge of the patella represent marked irritation in use, and frequently catch one upon the other, causing the locking or catching sensations so often described. To control the irritation in the extreme cases complete fixation may be necessary during the acute period. In the mild cases flannel or compression bandages, by their compression and from the mere bulk, frequently control the irritation sufficiently. For this same purpose the adhesive-plaster strapping is of much value, and is applied as has been described in the article on Chronic Villous Arthritis.

In the hip, which is probably the hardest joint to control satisfactorily, complete fixation with plaster-of-Paris or stiffened leather spica bandages in the extreme cases is necessary. In the milder cases more flexible supports, such as flannel spica bandages, may be adequate, but in all the principle of treatment is the same—*i. e.*, protection and restriction of use during the active or painful stage.

In the spine, which is quite commonly involved, the same principle holds, and the mode of application depends upon the portion of the spine involved. In the cervical region the Thomas collar is probably the most practical. This can be made of almost any material, the idea being to have a dressing of sufficient bulk, so that the motions of the head and neck are restricted. The most perfect form of collar is made of leather board cut out so as to conform to the shape of the neck and shoulders, the edges of which should be padded, and, when covered, can be laced in the back. Such a dressing, if well fitted, can be almost entirely concealed in the ordinary costume of man or woman.

If the region of the spine involved is lower down, if in the lumbar or lower half of the dorsal region, jackets made of plaster-of-Paris or stiffened leather are the most desirable if the process is at all acute. If not acute, or for convalescent support in the acute cases, corsets made of canvas or heavy webbing are sufficient. If the disease is in the upper dorsal region, braces such as might be used for Pott's disease are at times indicated.

Operative Treatment.—The operative treatment of the hypertrophic form of arthritis consists simply in the removal of such nodes or synovial fringes as may have formed, and which, by their presence, interfere with the joint action. In many joints this is, of course, not possible, but in others, especially the exposed joints, such as the wrist, elbow, knee, and ankle, such operations are desirable. The operation in the given case depends, of course, upon the location and extent of the disease, but the principle should be thoroughly to remove the thickening which is particularly interfering with the joint action, being careful to avoid any unnecessary irritation of the joint. In these cases there is, of course, no need of drainage, and the after-treatment should consist of immobilization for three or four days, after which gentle passive motion should be started and gradually continued until the maximum amount is reached.

INFECTIOUS ARTHRITIS—RHEUMATISM

Inasmuch as the joint symptoms in this type of disease may be produced by a large number of different organisms, the special features demanding surgical interference necessarily vary considerably. In the mild forms, all that is necessary is the protection of the affected joint during the active stage of the disease, in order to prevent deformities, either contractures or dislocations, which may result from attitudes assumed during this inflammatory stage. After the inflammatory stage has subsided, if adhesions have resulted, they should be freed by manipulation; and if deformities have resulted, they should be overcome, and the joint function restored to as nearly the normal as possible.

Not infrequently in this type of disease the joint swelling and tenderness persist for a long time after the acute symptoms have subsided, due to the fact that villi have formed as the result of the action of the organisms in the synovial membrane, or that the fibrin in the joint fluid is coagulated. These two features mechanically keep up the irritation within the joint, and the pain and swelling are continued, not because of the original inflammation, but because of the mechanical presence of these irritants. At times these features are so slight that, by means of bandaging and strapping, they can be sufficiently controlled. At other times incisions are necessary for their removal, and the special technic in a given case would depend upon the joint affected and upon the location of the villi. In certain of the cases of infectious arthritis the organisms which are present in the given joint or joints are of such virulence that profound constitutional disturbances result. In these cases there may be marked infiltration of the capsule and all the periarticular structures, or with certain of the organisms definite suppurative changes may develop. In these cases surgical interference is indicated as soon as it is definitely determined that the symptoms will not subside under conservative treatment. In the suppurative cases the evidences of suppuration are usually apparent, so that the need of incision is beyond question. In the cases in which the articular and periarticular structures are infiltrated, with marked suffering, but without evidences of suppuration, the operation should be performed in order to prevent the further infiltration of the tissues and the consequent thickening of the capsule, which would finally result, in these cases, in stiffened joints.

The spine, which is very frequently affected in connection with the various infections, such as typhoid, gonorrhea, grip, etc., should be fixed during the active stage of the process. For this purpose the plaster-of-Paris jacket is the most satisfactory, and it should be continued until the acute symptoms subside. In case abscesses result, as they do in certain virulent forms, they should be drained as soon as their existence or location can be determined.

In the other joints the principles which have been stated should be adapted to the part and the individual.

DISEASES OF THE RESPIRATORY SYSTEM

DISEASES OF THE NOSE AND THROAT

By Charles W. Richardson, M.D.

ACUTE RHINITIS

Acute rhinitis is an acute inflammation of the mucous membrane lining the nasal cavities. An acute catarrhal inflammation of the nasal chambers is attended with the usual pathologic changes and clinical manifestations which characterize acute inflammation of the mucous membrane in general, presenting in the nasal chambers, however, alteration due to the participation of the submucous turbinal tissue in the inflammatory process. It is also to be noted that the inflammatory activity is very rarely limited to the nasal chambers. Extensions most frequently take place to the pharynx and larynx, to the Eustachian tube, and through them to the middle ear, and less frequently to the accessory cavities of the nose, as the antral, frontal, ethmoid, and sphenoid sinuses.

The occurrence of acute rhinitis at certain periods of the year in apparent epidemic form would seem to lend support to the theory that it must have a specific origin. A host of rhinologists have striven to isolate a micro-organism as the infectious agent in producing acute rhinitis, but their efforts have been unavailing. While it is possible that acute rhinitis may be an infectious disease, no one has yet discovered the acceptable micro-organism, nor has it been possible by inoculation with the serous exudate from the affected nasal cavities to produce the disease. The most probable reason why acute rhinitis is so prevalent during the late fall or early spring is because the atmospheric conditions are then most favorable to the excitation of cold-catching, and because the greater number of people are unprepared, or neglect the necessary hygienic rules as to clothing, diet, and the heating of their homes, thus rendering themselves susceptible to the action of these altered atmospheric conditions.

An acute rhinitis is a self-limiting disturbance, terminating in more or less complete return to the normal in from four days to a week. It is attended with characteristic, local and systemic symptoms, the severity of the latter varying greatly in different attacks. The prognosis is very favorable as to recovery. Caution should be exercised as to the prognosis in the very young and in the aged, as extension may give rise to serious involvement of pulmonary organs.

Treatment.—A most important feature in the treatment of acute rhinitis is the teaching of our patients to become practically immune to this ailment. They must be taught the ordinary hygienic rules with regard to the body and its proper regulation; the character of the food they must eat; the clothing they must wear; and the protection of which they must avail themselves during the changeable atmospheric conditions. A moderately cool bath, between 55° and 65° F., taken on arising in the morning, acts as a delightful tonic and stimulant, and renders one markedly immune to ordinary atmospheric changes. The underclothing forms also an important feature in connection with prophylaxis. I find that most of those I observe either clothe themselves too warmly or too lightly. I find that of all underwear the linen-mesh is the form that is the most protective, the most hygienic, and the most suitable for temperate climates. Proper regard should be had to footwear. It is more frequently through our feet that we contract cold than through other means. The shoes for out-of-door wear should have thick soles, and, when permitted to become wet or damp, should be immediately changed. Rubber overshoes should always be worn on a damp or rainy day. All wrappings about the neck, consisting of mufflers, scarfs, and feather or fur boas, should be discarded. The amount and character of exercise in proportion to the need of the individual should be indicated. All chronic changes within the nasal chambers should be corrected, deflected septæ straightened, and spurs removed.

It is greatly to be deprecated that an acute rhinitis is considered such a trivial affair by the average layman, and that it is permitted, in the large proportion of cases, to follow its own course without effort to bring about a perfect resolution. It would be well if we could educate the laity as to the seriousness of neglected acute rhinitis and the importance of bringing it to a quick resolution. It seems, during the early stage, that there is no doubt that the attack can be speedily brought to resolution by resorting to the abortive treatment. The patient should be put to bed, or, at least, confined for twenty-four or forty-eight hours within doors. This confinement is not always possible, but it is desirable, when practicable. The important part in the early treatment is the restoration of the equilibrium in the disturbed action of the skin and the other organs of elimination; this is best accomplished through active diaphoresis and local depletion. The diaphoresis can be as well excited by the administration of a copious draft of a tasteful hot drink as through the agency of drugs. The diet should be limited to food of a strictly liquid character. A Dover's powder of 10 grains, or 5 grains of bromid of quinin, may be given at bedtime. As a good derivative, as well as for its active depletory effect, calomel in divided doses, followed by a saline purge in the morning, materially aids the resolution. Especially is calomel of value when rhinitis is apparently due to errors of diet or disturbance of digestion. For purposes of active local depletion, I know of no remedy that acts so thoroughly as a tablet of $\frac{1}{6}$ grain of chlorid of sodium introduced in each nasal chamber, as suggested by Kyle. When the patient cannot be confined absolutely to the house, but is able to remain within doors the greater portion of the day, I have found codein and ammonia carbonate, in cherry-laurel water, by its mild diaphoretic action, to accomplish great good. The solution is administered as follows:

℞.	Codeinæ	gr. j	(0.06)
	Ammoniæ carbonatis	gr. xxiv	(1.50)
	Syrupi tolutani	ʒ vj	(24.00)
	Glycerinæ	ʒ iv	(16.00)
	Aquæ laurocerasi	ad q. s. ℥iij	(90.00)

Sig.—Teaspoonful every hour until fourth dose, then every two hours.

For relief of head pain, I find that applications as hot as can be borne, and applied as continuously as possible to the forehead, afford the greatest relief. If the abortive treatment fails, as it will in many cases, the further treatment must be symptomatic. The bowels should be kept freely evacuated, with morning and evening doses of a tablespoonful of effevescing sodium phosphate. Acute rhinitis occurring in the lithemic can be best combated by a strict dietary and the administration of lithia and sodium phosphate. In the rheumatic, the constitutional treatment should be the salicylates, or salicin; in the malarial, brisk purging with calomel, followed by the administration of quinin. Should the distention of the turbinates be so great as to give rise to distressing symptoms, temporary relief may be afforded through the application of suprarenal extract. Suprarenal extract depletes through contraction of the turbinal vascular tissue. It may be used by spraying, or, better, by saturating pledgets of absorbent cotton with the solution and introducing these into the nasal chamber, where they are allowed to remain a few moments, after which the cotton is removed. Suprarenal extract is a most advantageous drug for depletion by contraction, as it has even a more thorough, as well as more prolonged, action than cocain, and is unattended with any of the dangers of the latter drug. The suprarenal extract can be used comparatively freely, as it does not seem to have any unpleasant constitutional effects when thus used locally. It is best used according to the following formula, as suggested by Ingals:

℞.	Adrenals	ʒj	(4.00)
	Acidi borici	gr. xv	(1.00)
	Aquæ camphoræ (hot)	℥j	(32.00)
	Aquæ destillatæ (hot)	℥j	(32.00)

M. Macerate for four hours, then filter.

I should advise due caution in the use of adrenalin, for the reason that it occasionally excites most violent paroxysms of sneezing, which may continue for several hours.

In the second stage, attended with the profuse mucopurulent discharge, I find that the spraying of the nose with a mild alkaline tepid solution three or four times daily gives marked relief. This solution may consist of bicarbonate and biborate of soda, 5 grains of each to the ounce of tepid water; and a solution equally as good for the same purpose can be made by dissolving one of the nasal plasma tablets in two ounces of tepid water. A very comforting solution for this purpose can be made by dissolving 5 grains of sodium chlorid to the ounce of tepid milk. Another excellent solution is a 3 per cent. solution of boric acid. After a thorough cleansing with one of the above solutions, the application twice daily of a menthol-camphor-iodin solution, in which benzoinol or other form of refined petroleum is the menstruum, not only adds greatly to the comfort of the patient, but also aids materially in bringing about resolution. If the local condition seems to be following a protracted course, in spite of agents employed, it is wise to use some mild astringent in aqueous solution to aid in bringing about resolution. The two best agents of this class are either 1 per cent. solution of silver nitrate, or chlorid of zinc. The acute rhinitis occurring in early infancy is an extremely distressing affection, as, through its obstruction to normal respiration, it interferes seriously with the sleep, prevents the ingestion of food, and may, by impairing the nutrition, give rise to other serious complications. Great relief can be given these little sufferers by irrigating the nasal chambers with a tepid alkaline solution introduced by means of an eye-dropper. The head is well held and the tip of the eye-dropper is introduced just within the vestibule of the nose and the solution forced through drop by drop until each nasal chamber is cleaned. The use of the alkaline solution can be followed by a few drops of a 1 per cent. solution of camphor in benzoinol or albolene.

EPISTAXIS

In order to understand the rationale of the treatment of epistaxis, it is essential to have a thorough knowledge of the many conditions which may give rise to nasal bleeding. Among the etiologic factors causing nasal hemorrhage may be mentioned traumatism, foreign bodies, internasal operations, anemia, both simple and pernicious, plethora, purpura hemorrhagica, the hemorrhagic diathesis, diseases of the heart, liver, and kidneys, typhoid and relapsing fever, vicarious menstruation, and local pathologic changes within the nasal cavity. Among the local conditions infrequently causing nasal hemorrhage may be mentioned the benign and malignant growths, such as angioma, angiosarcoma, fibroma, and carcinoma. By far the most frequent conditions giving rise to epistaxis are the local changes in the nasal mucosa covering the anterior portion of the cartilage of the septum. Changes in the mucosa are most frequently observed in nasal chambers presenting a moderate deflection of the septum or a spur. The bleeding may take place from either the concave or the convex surface. It is at times due to thinning of the mucosa, which has been produced by the frequent picking of the nose to remove incrustation; in other cases, to a thickening of the mucosa, with marked increase of the vascular elements of the membrane. At times the increase of the vascular elements of the mucous membrane is so marked as to form a small bunch of vessels, about the size of the head of a small pin, standing out from the surface of the mucosa, visible from their slight prominence as well as their more intensely deep red hue. Hemorrhage from the nose ranges from a few drops to so great an amount as to exsanguinate the patient. Treatment properly carried out should always arrest the flow of blood.

In the treatment of nasal hemorrhage, first consideration should be given as to the etiology of the bleeding, whether it is of constitutional, traumatic, or local origin. The history of the case, the condition of the patient, and the manner of the onset of the hemorrhage, which can be quickly obtained, will serve to elucidate these points. Whatever the cause of the hemorrhage, the nasal cavities should be carefully examined under good illumination before any blind attempt is made to arrest the hemorrhage. One important point to remember is that frequently recurring hemorrhages from one side usually indicate a local lesion, while hemorrhage from both sides would rather point to some systemic origin. Hemorrhage from systemic disturbances is also usually preceded by prodromal symptoms, such as fullness in the head, vertigo, throbbing of the temples, headache, and giddiness. In those hemorrhages dependent upon systemic disturbances due attention must be given to the general condition. In plethora and in certain cardiac conditions it may be expedient to allow the bleeding to continue, being careful to see that not too much blood is lost. In hepatic conditions a brisk saline and a blister over the liver are ofttimes very efficient agents in arresting the persistent oozing. In diseases of the kidney and the various forms of anemia appropriate general medication should be carried out at the time of the hemorrhage and subsequent thereto, to prevent a recurrence. Frankel cites instances where periodic nasal hemorrhages were arrested by the administration of large doses of quinin.

Local Treatment.—As stated above, the preliminary local treatment of all forms of nasal hemorrhage is a thorough inspection of the nasal cavities under good illumination. It is only through this inspection that we are enabled to locate the source of hemorrhage and to adopt the procedure that will be effective and thorough. In the vast majority of cases the hemorrhage will be noted to be a small point on the septum just within the vestibule of the nose opposite to the anterior extremity of the inferior turbinate body. In children the source of hemorrhage is, in fully 95 per cent. of cases, from the above indicated point on the septal wall. If the hemorrhage has ceased spontaneously, or has been arrested through the efforts of the family, the examination is equally as important as though the hemorrhage were occurring at the time of the physician's arrival. Blood-clot which may have formed, and packing which may have been introduced into the nasal cavities, should be cautiously removed in order to obtain an unobstructed view of the whole nasal tract. Gently syringing the cavities with normal saline solution at 100° F. will expedite the removal of adherent clots. Most frequently it will be readily seen from which cavity the hemorrhage is issuing; at other times, on account of the blood-clot having filled up the bleeding cavity, the blood flows backward over the soft palate and out of the non-hemorrhagic cavity. The removal of all clots will here disclose the fact whether the hemorrhage is bilateral, as well as from which cavity it has its source. At times the removal of clots and packing, when done with care, will not cause a recurrence of the bleeding which has been arrested, or increase the flow of hemorrhage noted at the commencement of the inspection. Under these circumstances inspection is made without much difficulty. Even when the hemorrhage is started afresh or intensified by the above mentioned procedure, if the field is once made free, through quick inspection the source of hemorrhage can be readily located. We are wonderfully aided in these efforts of inspection by having ready several pledgets of absorbent cotton, so large as to be able to enter the nasal cavity, saturated with a solution of suprarenal extract, or one of its reliable derivatives, which is quickly inserted into the bleeding cavity immediately after it is cleansed; this saturated pledget is allowed to remain in the nasal cavity a few minutes. Usually while the pledget is in position the hemorrhage will cease, and almost always it will be considerably lessened for a few seconds after its removal, during which time the inspection should be made. Unmedicated pledgets of cotton have aided me wonderfully, employed in the same manner, in momentarily stilling the active bleeding and thus enabling an inspection to be made. When the hemorrhage is lessened markedly, or momentarily stilled, by the pressure of a pledget of cotton introduced within the anterior nares, we may be fairly assured that the source of the hemorrhage is from the anterior portion of the septal mucosa. Hemorrhage from the septal mucosa can be most effectively and thoroughly arrested by cauterizing the bleeding point with chromic acid fused on the end of an applicator or probe. The nasal cavity should have firmly inserted into it a medicated or non-medicated pledget of cotton directly over the bleeding area, while the chromic acid probe is being prepared. The acid should be allowed to fuse at the very extremity of the probe—a small pinhead bead is all that is necessary. The probe armed with the acid being ready, the cotton is removed from the nose, and, before the hemorrhage is allowed to start briskly, the chromic acid is quickly and gently applied to the bleeding point. If the cauterization is successful, a grayish-white, slightly raised eschar is formed at the point touched, and the hemorrhage is arrested. If the procedure is not successful, it will be necessary to wipe away the partly raised eschar with a pledget of cotton and reapply the chromic acid. I have never known this method of attacking a nasal hemorrhage, in the form to which it is applicable, to fail to arrest the bleeding absolutely and completely. It has also the signal advantage of leaving the nasal chamber free to perform its physiologic function. It is usually wise to keep the patient absolutely quiet for an hour or so after the hemorrhage has ceased. No cleansing of the nose is permissible for fully six hours after the bleeding is arrested. About the second or third day the slough begins to disintegrate. The slough may disintegrate molecularly or come away in one mass. It is at this period that secondary bleeding may take place; secondary bleeding is more apt to occur when the slough comes away en masse. Careful supervision of the patient at this period, with the gentle cleansing of the nasal cavity by the physician once or twice daily, will usually tide the patient in safety over this period. Bleeding angioma of the septum, a small hemorrhagic tumor, usually well pediculated, should be at once removed with snare or forceps and the seat of attachment touched with chromic acid. Cases of hemorrhage having their origin from a semi-malignant or malignant growth form an exceedingly infinitesimal proportion of all cases observed. In such instances the amount of the hemorrhage, its frequency, the nature of the growth, and the immediate or remote possibility of surgical dealing with the condition influence us as to the method to be employed in connection with the hemorrhage. Traumatic hemorrhage is usually best arrested through the properly applied surgical methods to restore displaced fragments of nasal bones or septum, and through the pressure of the retaining apparatus or packing which is used to maintain them in position.

When the seat of the hemorrhage cannot be located, is of systemic origin, is from a malignant growth, or when the above indicated methods have failed, other methods must be employed to control the bleeding. Of the various astringent agents, alum in 4 per cent. aqueous solution is the only one of any value that does not possess disadvantages. The iron solution should never be used. Douching the bleeding cavity with water as hot as can be borne is said to be effectual in controlling the bleeding. Insufflation of the powder antipyrin, or the use of a 10 per cent. aqueous solution of the same drug, is also efficacious. Its application is attended with quite sharp momentary pain. Hydrogen peroxid syringed into the nasal cavity is also an efficient agent at times. In the dried extract of the suprarenal glands, or its so-called active principle, adrenalin or suprarenalin, we have the most potent drug yet presented to the therapeutist for arresting hemorrhage from the nasal cavities. I prefer to use this agent in a solution of the dried extract of the glands prepared according to the formula as suggested by E. Fletcher Ingals, which is as follows:

℞.	Adrenals	ʒj	(4.00)
	Acidi borici	gr. xv	(1.00)
	Aquæ camphoræ (hot)	℥j	(32.00)
	Aquæ destillatæ (hot)	℥j	(32.00)
M.	Macerate for four hours, then filter.		

The adrenalin and suprarenalin at times provoke most exasperating attacks of sneezing, which, occurring in a case of hemorrhage, would be quite disastrous. The solution may be either sprayed into the bleeding nasal chamber, or, what is more effectual, large pledgets of absorbent cotton saturated with the solution may be introduced into the hemorrhagic cavity. After the pledgets of suprarenal saturated cotton are allowed to remain in the nasal cavities for a few moments, it will be noted that the hemorrhage gradually subsides until it ceases entirely. After the hemorrhage has ceased, the pledgets may be removed or allowed to remain for twelve or twenty-four hours. I have no faith in the generally accepted belief that the use of suprarenal favors secondary hemorrhage, as I have never heard advanced any sound therapeutic reason for this assertion, and I have never witnessed the occurrence. Should the above procedure fail in checking the flow of blood, we may resort to the douching of the nasal chambers with a 10 per cent. solution of gelatin. When all these methods have failed, or for various reasons the condition of the cases seems to demand it, we must resort to tamponing the nostrils. The most elegant and simplest agent for tamponing is the Bernay's compressed sponge. These sponges are made of cotton material, sterilized, and are highly absorbable; through the absorption of moisture they expand, and thus produce pressure. When it becomes necessary to pack the anterior nares, a long strip of gauze, about a yard long and from one-half to an inch in width, should be used. This gauze may be simple sterile or iodoform gauze, and it may be used dry or saturated with some hemostatic solution. I prefer the solution of suprarenal for this purpose, but have also found, in former days, a 15 per cent. solution of the aceto-tartrate of alum admissible for this purpose.

Under good illumination and with the use of the speculum, the gauze is picked up by its end with nasal dressing forceps and carried directly back along the floor of the nose until the posterior nares is nearly reached; the gauze is then packed in successive loops from below upward and from behind forward until the whole nasal chamber is filled and the anterior nares reached. The firm pressure exerted by the gauze packing, in the great majority of seemingly intractable cases, brings the bleeding to a close. In all cases, however, in which anterior packing has been employed, examination of the pharynx should be made every few minutes for at least ten minutes after the bleeding has apparently ceased, to be assured that the bleeding is really stilled and not now coursing down the posterior wall of the pharynx into the gullet, instead of flowing anteriorly. If the hemorrhage is from a point so far back that the anterior tampon does not arrest it, or the anterior tampon allows leakage into the nasopharynx, then the posterior nares must also be tamponed. In order to place the posterior tampon in position, it is necessary to pass a stout cord about one yard long through the nose into the pharynx and out of the mouth. A small-sized soft-rubber catheter, to which the cord is attached, is passed through the nares into the pharynx. When the end of the catheter is seen protruding below the velum, it is grasped with forceps and brought out through the mouth and the end detached. Due care should be exercised in the management of the ends of the cords while preparing the tampon. The tampon made of gauze, just of sufficient size to fit snugly into the posterior nares, should be tied firmly and securely about 12 inches from the end of the cord protruding from the mouth. The tampon, having been dipped into the hemostatic solution, is then drawn into position by traction made upon the end of the cord protruding from the anterior nares. The patient's mouth must be held wide open and the soft palate hooked forward with the index-finger of the left hand, in order to allow the tampon to slip up behind the palate into position. After the posterior tampon is in position, the anterior tampon must be replaced, and the cords strapped by adhesive plaster to the side of the face. The tampon is allowed to remain in position from twenty-four to forty-eight hours. The anterior tampon is thoroughly moistened and then extracted. On the extremity of the cord protruding from the mouth gentle traction is made, with the index-finger pressing against the end close to the palate, so as to make the direction of the traction downward and backward. Under slight traction, as above described, the plug slips out from its position.

It is important to remember that most cases of nasal bleeding cease spontaneously, in spite of the various maneuvers that the layman adopts to arrest them. It is also to be remembered that quieting the fears of the patient and those about him, sending away meddlesome friends, and causing him to desist from all procedures which have been maintaining the hemorrhage, will often have as much effect in arresting the hemorrhage as the agents that you will employ. It may even be necessary to administer a hypodermic of morphin. If the hemorrhage has been very severe, it may be necessary to resort to hypodermoclysis. The pengawar djambi, a silky like vegetable fiber imported from India, has been used for locally arresting nasal hemorrhage. I made many experiments with this agent some years ago, and found it is of no special value. Internally gelatin and calcium chlorid in appropriate dosage may be administered.

HAY-FEVER

The condition which passes under the term of hay-fever is a peculiar vasomotor disturbance of the upper air-tract, having a stated onset and termination, and evidently due to some form of toxemia. There are other conditions similar in many of the pathologic features and symptoms to hay-fever, but lacking the feature of periodicity. These conditions are known as perennial vasomotor coryza. One of the interesting features about hay-fever is the absolute periodicity of its onset, usually about the middle of August, and its abrupt termination at the coming of the first frost. Hay-fever is generally considered to have three essential factors entering into its etiology, the existence of all being essential to the production of the paroxysm; these are the local source of toxic irritation, the receptive mucous membrane, and the neurotic temperament. The local sources of toxic irritation are responsible for the periodicity of the attack, as well as its sudden termination. In the United States we find that the pollens of the ragweed and the goldenrod are the most active agents in furnishing the source of a local toxic irritation. Any deviation from the normal in the nasal mucous membrane, from a simple catarrh to gross pathologic changes, may make the nasal tract the receptive surface for the local toxic agent. The etiologic factor which plays the all-important rôle is the general systemic disturbance, the so-called neurotic temperament. The systemic disturbance in hay-fever is manifested by periodic loss of control of the vasomotor nervous distribution to the upper air-tract. The condition which brings about this disturbed innervation of the general nervous system is evidently the result of faulty metabolism and imperfect elimination—a state of autointoxication. Heredity seems to play a strong rôle, but only in so far as the child is susceptible to the same systemic infection that affects the parent.

In the early attacks of hay-fever the symptoms are typically "booky," in that they follow the symptomatology exactly as described by the text-books. After several attacks the symptoms often become irregular, with a tendency to prolongation of the attack, and an increase of the pulmonary symptoms.

The prognosis, as far as life is concerned, is favorable. When asthma has supervened, the lot of the sufferer is indeed a very unhappy one. Relief during the attack can usually be secured if the patient is able or willing to seek the place where he is immune and abide there until the time of the usual termination of the attack. Thoroughly carried out systemic and local treatment promises more for permanence of cure at the present time than in former days. It is too early yet to offer criticism on the various forms of immunizing treatments.

Treatment.—In the consideration of the treatment of hay-fever we shall first discuss the course to be adopted during the intervals between the attacks, and, secondly, the course to be pursued during the period of invasion.

Treatment During the Interval.—At this period, and especially several months previous to the onset of the attack, there should be a careful clearing up of the patient's general system and the removal of any local pathologic changes. There should be a careful consideration of the etiologic factors, especially wherein they influence the attack as occurring in the individual under consideration—they should be eliminated or their potency diminished. The general hygienic surroundings of the patient, his sanitation, as well as his physical regimen, should be carefully considered and regulated. We usually find that those who are subject to attacks of hay-fever are individuals following intellectual rather than laborious occupations, those not given to physical exercise, of sedentary habits, with a nervous inheritance, and in the well-to-do class of society. These people usually spend many hours of the day in badly ventilated and imperfectly lighted office buildings, subjected to more or less nervous strain or work that requires a high degree of mental activity. These same individuals usually take—or have—no opportunity for open-air exercise, and most frequently spend their evenings in a diversified occupation, called social duties, which entails continuous mental effort. All these false methods must be eliminated, and their daily life must be so proportioned as to give them a fair amount of health-giving, pleasurable, out-of-door exercise or occupation proportional to their indoor work. They must work under better hygienic surroundings, they must decrease the hours of mental strain, they must take active exercise in the open air, and have a more rational and suitable diet prescribed, to which they must strictly adhere. As long as there is evidence of a deficient elimination of the products of imperfect digestion, or the accumulation of those chemical elements in the blood—present only when the relations between assimilation and elimination are not normal—the condition of the patient's alimentary tract, the state of his blood, and the various organs of elimination should be carefully studied and methods should be adopted to correct errors, aid elimination, and arrest abuse. There is no one fact more thoroughly brought out in the pathology of hay-fever during the past decade than that the systemic disturbance, the so-called neurotic condition, is most frequently the product of faulty metabolism and imperfect elimination. Therefore, the sum and substance of our whole managerial efforts should be the adoption of all those various means that will aid us in bringing about perfect metabolism and thorough elimination of waste product, through observance of the natural physiologic laws, summoning to our aid drugs only when the exigencies surrounding individual patients demand such a course. I usually find it expedient to give a dessertspoonful of the effervescing phosphate of soda night and morning, to be increased or diminished according to its action upon the bowels. I find that the lithia salts, in some forms, are demanded in some cases, or the use of the natural lithia water. The free and liberal use of water for drinking is especially to be commended to those under preventive treatment. Cold bathing, cold spraying, and the cold bag to the spine—the last-named in those showing other vasomotor disturbances—are especially applicable. The typical neurasthenic requires the benefit of the rest-cure. Among constitutional remedies certain tonics, alteratives, and nervines are found of special value. These drugs may be used singly or in combination, as circumstances may demand. Among the tonics are iron (Blaud's pills) and strychnin; among the alteratives, arsenic; and among the nervines are belladonna and phosphorus. During this period the local conditions within the nasal chamber demanding treatment should receive careful attention. All operations should be done early enough to permit the nasal organs to return to the normal at least a month before the expected paroxysm. Hypertrophies, when occluding one or both nasal cavities, should be corrected, new-growths should be removed, and spurs and deflections, when interfering with normal nasal respiration or causing continuous contact, should be corrected and removed. In some individuals the complete cessation from occupation, removal of apparent source of local irritation, and change of environment, habits of life, and location are the most potent and only influences that will bring about anything approaching a permanent result.

Treatment of the Attack.—The most satisfactory treatment for the attack is to send the patient at once to one of the immune places, there to abide until the occurrence of frost at his place of habitation. Some people seem to feel the greatest benefit from a sea voyage or the abiding on an island in the sea so distant that the influences of breezes from the mainland are lost. Others get the greatest practical benefit from going to the northern mountains or the lake regions of Canada. The White Mountains have one or more immune places. The immune place from which my patients have gained the most uniformly good results is Bethlehem in the White Mountains. If the patient is obliged to remain at home, then great relief can be assured him by appropriate general and local treatment. The acid treatment, as suggested by Bishop, seems frequently to give highly satisfactory results. Bishop gives during the attack teaspoonful doses of Horsford's acid phosphate, liberally diluted with water, two or three times daily. He claims that it lowers the alkalinity of the blood so that it lessens its solvency for the uric acid. The dilute nitromuriatic, the hydrochloric, or the nitrohydrochloric may be used in place of the phosphoric acid. The diet should be carefully regulated, the digestion corrected, and the amount of work diminished. Among constitutional remedies those that tone up the nervous system should be administered, such as iron, strychnin, and phosphorus. For the local relief of the disagreeable symptoms attendant upon the paroxysm we have no drug that equals the results often attained by the local application of the suprarenal extract. Locally the drug should be used in the aqueous solution of the powdered glands, prepared according to the formula suggested by Ingals. The adrenalin or suprarenal may also be used. Previous to the use of the drug the nasal cavities should be well sprayed out with a carbolized alkaline solution. After the cavities have been cleaned, a pledget of cotton thoroughly saturated with the solution of suprarenal is then introduced into each nasal cavity, where it is allowed to remain a few moments. The solution may also be used by spraying it through an atomizer into the nasal chambers. This local use of the suprarenal glands will not always give absolutely certain results, but it will give more or less relief, and more relief than almost any other local agent that I know of, and, so far as we are aware, with no unpleasant after-effects. The applications must be repeated as frequently as the effect produced and desired passes away. Cocain has been extensively used to give relief from the persistent nasal stenosis. The action of cocain is only transitory, possesses no degree of permanency of action, and is attended with the strong possibility of giving rise to the habitual use of the drug. E. W. Wright, who lays great stress upon the hypersensitive condition of the nasal mucosa as the important etiologic factor in many cases, suggests a frictional massage of the mucous membrane of the nose, in order to increase its resisting powers, so that it can withstand the irritation and excitation from the impact of the pollen of plants. His method of treatment is to apply gentle massage to the nasal mucous membrane through the medium of a cotton-covered probe. These applications are to be made for from three to five minutes in each nasal chamber.

Various investigators have attempted to obtain an antitoxin which would, through its administration, prevent or control the toxemia. The latest antitoxin heralded for this purpose is the antitoxin serum of Dunbar, the so-called pollantin. The pollantin which was imported into this country previous to the present year was made from grasses, and therefore should theoretically be of no value when used to prevent or control hay-fever produced by the ragweed or goldenrod. A considerable degree of success was claimed by those using the serum during the year 1903; with a more variable degree of success in the use of the 1904 serum. It is early yet to come to any conclusion with regard to the value of the pollantin. Its success, so far, certainly justifies its use, both as a preventive and as a controller. Dunbar himself hardly claims it as a specific.

CHRONIC RHINITIS

In the general consideration of chronic rhinitis we have two conditions under discussion which are entirely different in the causation of their pathologic features and clinical symptoms, as well as the characteristic objective evidences, as demonstrated by anterior and posterior rhinoscopy. In the one condition, the hypertrophic rhinitis, we have the swelling of the mucous membrane, which is attended with permanent dilatation of the blood-vessels and increased growth of the intravascular connective tissue, with the alteration of the quality of the secretion; in the other, the atrophic form, we have a diametrically opposite condition. In this we have a chronic inflammation of the nasal chambers, having an uncertain onset and an indefinite duration, being attended during its course with the increasing and progressive destruction of the glandular and epithelial structures, and the formation of crusts and scales within the nasal chambers, which occasion an offensive odor, terminating in a true sclerosis of the nasal mucosa and atrophy of the turbinal osseous tissues. In the former condition—that is, of the chronic hypertrophic rhinitis—we have also a milder type of inflammation, in which the swelling of the mucous membrane is moderate and the change in the secretion is more pronounced, it being a hyperemic rather than a hypertrophic process. In treating these two subjects under one heading, it is probably better to give the treatment of one condition—the hypertrophic—first, and then the treatment of the atrophic form.

In the consideration of hypertrophic catarrh it is necessary to bear in mind the fact that the nose is an extremely actively worked organ. Its physiologic functions should be well carried in mind; this fact being that the nose has for its function the meeting of the various changes of the atmosphere and preparing the incoming air for proper pulmonary respiration. The nasal organ, in the passage of the atmosphere through its cavities, brings the temperature of the inspired air to 86° F. and gives it a full degree of saturation before it reaches the pharynx. Knowing these facts, we can readily understand that atmospheric conditions, with regard to its vagaries, as to its density, humidity, and temperature, the changes produced by artificial heating and overcrowding, dust and emanations contained therein from animal contamination, all call upon the nasal chambers for frequent active changes in its vascular tension. The occurrence of frequent acute attacks which are neglected and not brought to resolution leaves after each succeeding attack a certain amount of residual inflammation, which often terminates in hypertrophy. Climate, no doubt, has considerable influence in producing hypertrophic change. A moist atmosphere with frequent and sudden changes—in both the degree of humidity and temperature, such as is noted along the Atlantic seaboard and the Lake region—is an active agent in producing hypertrophic changes. Constitutional diseases and errors of digestion, as well as excesses of various characters, are very active in producing, secondarily, the changes in the nasal mucous membrane which are treated of under this heading. Local changes noticed in the nasal cavities themselves in the way of deformities, either as deflections or spurs and hypertrophies of the glandular structures in the fauces, are important points for consideration in the treatment of this condition.

In the atrophic rhinitis we must bear in mind the fact that the disease is a condition which has never been traced from its incipiency throughout its life history to its termination in any individual case. This important fact is one which I think causes a great deal of misconception as to the origin of this disease and the etiologic factors which are provocative of it. Atrophic rhinitis is a condition which may be manifest in very early life—most frequently becoming evident in young adult life. It is an interesting fact also in connection with this disease that it is more prevalent in the female sex than in the male in the proportion of three females to one male. In the practices of some the discrepancy between the sexes is found more marked, but I give these as the generally accepted figures. I have particularly noticed one important feature in connection with atrophic rhinitis, and that is the frequency with which atrophic rhinitis is present in the females of a family while tuberculosis is present in the male members of the same family. In order to appreciate somewhat the treatment of atrophic rhinitis, it is necessary to understand the various theories which have been advanced as to the causation of this disease.

1. The theory has been advanced that atrophic rhinitis is a sequel to an advanced form of hypertrophic rhinitis. According to this view, there is, first, the intravascular connective-tissue hypertrophy and cellular infiltration, followed by connective-tissue contraction, resulting in more or less obstruction of the nutrient arterial supply to the mucosa and osseous structures, producing an atrophic change in the mucosa.

2. The condition is the result of the anatomic alteration in the osseous framework of the nasal chamber that is due to (*a*) an abnormal widening; (*b*) the result of abnormal shortening.

3. That the atrophic rhinitis is the result of purulent rhinitis in

childhood, which, in its life history, develops and becomes the atrophic rhinitis of adult life.

4. That the condition is due to tropho-neurotic changes.

5. That the condition is due to suppurative changes in the accessory cavities.

6. That the disease is a form of rarefying osteitis. This theory is a very entertaining one, and has been receiving more and more adherence during the last few years. According to this theory, there is, first, a hypertrophy of the osseous structures; as the result of this hypertrophy, there is produced a pressure on the nutrient vessels in the osseous canals, whereby the nutrition of the mucosa at first, latterly of the bone itself, is impaired, all of which is attended with alteration of secretion and subsequent sclerosis of mucosa and atrophy of bone.

7. That the disease is the result of constitutional vice.

8. That the disease is the result of the activity of a specific bacillus.

Since the time when E. Frankel first made known his observations on the investigation of the nasal secretions for the purpose of separating the bacillus of atrophic rhinitis, numerous investigators have followed along this same line, among whom may be mentioned Löwenburg, Klamann, Thost, and Hajek. In 1893 Abel made known his discovery of a bacillus which he named bacillus mucosus, and declared that to this bacillus are due the changes which are noticed in atrophic rhinitis. He stated that it was never, or very rarely, found in any other diseased condition; that it was always présent during the activity of the disease, and disappeared with the disappearance of crust formation and fetor. The prognosis in connection with the hypertrophic rhinitis is very favorable. The simpler form, the hyperemic condition, can be readily brought into abeyance, with proper treatment, and with proper aid and support from the patient in carrying out the necessary restrictions with regard to living, hygiene, and exercise. The hypertrophic form is somewhat more obstinate, but usually, with careful and conscientious treatment, can be brought into abeyance. The atrophic form of rhinitis is a singularly difficult condition to treat, and the number of therapeutic agents which have been brought to our aid, their diverse character, and the often contradictory nature of these agents would suggest, if nothing else, the extreme difficulty, even futility, of all our efforts in conquering this disagreeable disease. While we are not able yet to bring this condition to resolution and restore the nasal chambers to their normal appearance, yet we are able to relieve the sufferers greatly from many of the disagreeable symptoms, as well as odor and crust formation, and to make their position in society one of comfort rather than discomfort.

Treatment.—In the treatment of hypertrophic rhinitis we should bring to our consideration the fact that the condition is not always a purely local pathologic change, but that there are many constitutional conditions and disturbances of the economy which have to be considered before we resort to local therapeutics. This condition requires a thorough consideration of the constitutional conditions, the hygienic surroundings, the manner of living, the character of the occupation, the habits and all factors entering into the daily life of the subject under consideration. Indeed, without a thorough correlation of the constitutional as well as the local treatment it is absolutely impossible to bring about a lasting effect as the result of treatment. We should carefully go into the hygienic surroundings of the patient and consider wherein they are defective as regards the care of the skin, the clothing of the body, the want of protection of the feet during damp weather, and, wherever found in error, they should be rectified. The question of diet should be carefully considered, and that which is suitable to the individual should be directed and insisted upon. It will be frequently observed that an office worker will be following a dietary suitable only for an athlete or a laborer. Particular attention should be paid to seeing that fresh air, without drafts, is obtained in sleeping apartments, dwellings, and offices; and that the general avoidance of overcrowded, badly ventilated halls and rooms of assemblage should be insisted upon. Exercise which is suitable to the occupation and the temperament of the patient should be directed. Good hours and the correction of habits of excess should be made obligatory when conditions demand them. Proper medication to meet constitutional disturbances that are directly or indirectly causing the nasal change should be considered. Moving from an unfavorable occupation or climatic surrounding is not always possible, but, when feasible, it should be done. In the treatment of this condition the consideration of the bearing of other organs and systems of the body, such as the cardiac, hepatic, gastro-intestinal, and the sympathetic nervous system, and their relation to these local changes, call for therapeutic attention to the correction of these organs or systems whenever disturbed, in connection with changes in the nasal mucous membrane. In this connection the importance of calling attention to the influence of the gastro-intestinal tract and its effect in producing crises of nasal hypertrophy, when disorganized, and the relief afforded in the prevention of these crises by their correction, shows what an important relationship this condition has with hypertrophic catarrh and the necessity of giving it thorough attention in our treatment of hypertrophic rhinitis. Numerous authors during the last three or four years, including Stucky, Coffin, and others, have written at length upon the importance of giving attention to the gastro-intestinal tract in this disease. The lithemic condition and its ally, rheumatism, require appropriate attention whenever they are present in cases of hypertrophic rhinitis. The lithemic condition is particularly provocative of that form of hypertrophic rhinitis which is known as chronic vasomotor catarrh, in which the hypertrophy is more marked at night, paroxysmal, and attended with violent spells of sneezing. The mucous membrane is intumescent, paler than normal, and presents alternating or complete stenosis of both cavities. Local treatment, unless attended with constitutional medication, instituted for the relief of lithemia, has no effect other than aggravating the condition. It is also well to bear in mind that neurasthenia is also attended with this particular type of hypertrophic rhinitis, and that, when such a condition is present, due regard must be had to the constitutional treatment of the nervous phenomenon. I have also frequently observed a form of hypertrophy which is somewhat allied to the neurasthenic vasomotor rhinitis, which is manifested in parturient women. This condition comes on about the third month of pregnancy and may last one or two months, or until the termination of gestation. This latter form is only relieved by topical medication. The local treatment, which plays an important rôle in the restoration to the normal of the chronic rhinitis, has for its object the reduction of hyperemia, the removal of structural hypertrophy, the lessening of cellular and glandular activity, and the restoration of the normal physiologic function of the nasal cavity. In the milder types of hyperemia and moderate degree of hypertrophy, especially those classed as vasomotor rhinitis, the local application of non-irritating alkaline solutions, to which is added some antiseptic agent, in conjunction with the thoroughly carried out plan of constitutional treatment and hygiene, will often bring about a complete resolution. The solutions which are most applicable for such purposes are as follows:

℞.	Sodii bicarbonatis		
	Sodii boratis		
	Sodii chloridi	āā ʒj	(32.00)
M.	Sig.—Small teaspoonful to a pint of warm water.		

℞.	Acidi carbolici	♏vj	(0.30)
	Sodii bicarbonatis	gr. xxx	(2.00)
	Sodii biboratis	gr. xlv	(3.00)
	Glycerini	ʒj	(4.00)
	Aquæ destillatæ	℥vj	(180.00)
M.	Sig.—For local use.		

To these solutions may be added, as conditions may demand, any one of the astringents, as nitrate of silver in 1 per cent. solution, or sulphate of zinc in ½ of 1 per cent. solution. These solutions are best introduced into the nasal cavity through the use of an atomizer. If the chambers are free from obstructions of any character, presenting only the hypertrophies, they may be used in the douche known as the Dessau of Birmingham douche. Due care should be observed to note that both nasal chambers are free enough to permit the return of fluids. The character of the atomizer, the amount of force used, and the general method of directing the spray should be carefully gone over with the patient. Patients are very much inclined, in spraying nasal chambers, to overdo the matter. This should be restricted to a simple cleansing of the nasal chambers in the morning on rising and in the evening on going to bed; in fact, I am not much of a believer in placing solutions of any kind or character in patients' hands for self-medication. It is always better for the physician, if possible, to have the local treatment thoroughly within his care, allowing the patient to use only a mild alkaline solution solely for cleansing purposes. When astringents are used in aqueous solutions, it is advisable thereafter to spray out the nose with one of the forms of refined petroleum, such as albolene or benzoinol; especially is this imperative if the patient is about to expose himself to the influence of the external atmosphere immediately after spraying with the aqueous solution. In the milder type of hypertrophy, as well as in vasomotor catarrhs, I find that a refrigerant alterative stimulant, such as the menthol-camphor-iodin solution, applied under the care of the physician every alternate day, or every day, has a decidedly beneficial influence on this condition, and is exceedingly agreeable and pleasant in its immediate effect. The menthol-camphor-iodin solution is as follows:

℞.	Menthol	gr. xxv	(1.50)
	Camphor	gr. vij	(0.50)
	Iodin	gr. ss	(0.03)
	Benzoinol	℥ j	(32.00)

Most frequently, however, these simple methods will not be attended with the desired result, and ofttimes at the beginning of the treatment the amount of structural change will demonstrate that the time so employed will be wasted, and that the only method by which results can be gained is through active local treatment. Many and various methods of treatment have been suggested for the purpose of reducing the hypertrophies, most of which are through the use of agencies producing more or less destruction of tissue. The method to be employed, the amount of reaction required, the agent to be applied, and the success obtained are usually the result of individual experience and skill. It is well to be skilled and experienced in all the various agents to be employed for this purpose, and then to use that agent which is most applicable to the case in hand and which will most thoroughly and quickly accomplish the sought-for result. The methods which are employed are pressure through the use of soft-rubber splints; cauterization, galvanic or chemical; the snare, hot or cold; and the more or less complete removal of the turbinate bodies. Wagner in his little book calls attention to the applicability of soft-rubber splints for the reduction of turbinal hypertrophies. In my observation, in the wearing of soft-rubber splints for the correction of deformities of the septum, I have been impressed with the thoroughness of the reduction of the hypertrophy in the turbinate when they existed, and with the permanence of this action. It seems, therefore, that those who are not inclined to surgical procedures would find this to be an efficient, if rather an unpleasant, method of accomplishing a rapid and radical resolution in their hands. Electrolysis has been employed to a greater or less extent for the reduction of hypertrophies of the turbinal tissue, but the fact that this method of treatment has not gained much support by extensive workers in rhinology would indicate that it has no advantages over other methods of treatment; its great disadvantages are the uncertainty of the result and the slowness with which it is gained.

The chemical cauterizing agents are chromic and mono-chloroacetic acid. They are especially applicable when the hypertrophy is uniform and not very marked, showing no tendency to form those masses known as anterior and posterior hypertrophies. In the application of these agents it is well to have the nasal chambers as free from moisture as possible, and make the points of application very limited in area, from which, as it were, to pin down the mucous membranes to the periosteum. If through these means a number of minute points of cauterization are made on the area of hypertrophy, there will be a gradual obliteration of the overdistended venous channels and a reduction of the intravascular connective tissue as the result of the adhesion and contraction at these points. The method of application is as follows: The nasal cavity is first thoroughly anesthetized through the means of cocain. The cocain is best used in a 5 per cent. solution and best introduced into the nasal cavities on a pledget of cotton saturated with the cocain solution, which cotton is allowed to remain in the nasal cavity for a period of from five to ten minutes. At the end of this time the cotton is removed. It will then be noticed that the anesthesia is quite complete. A few crystals of chromic acid are then collected on the end of an applicator, or probe, and fused over a flame; the acid collecting in a small crystal at the end of the probe. The nasal cavity is now dried with a pledget of dry absorbent cotton and the chromic acid is carried to the areas showing the hypertrophy, great care being exercised in touching only the areas in which it is desired to make the application. It is usually wise to wash out the nasal cavities with an alkaline solution afterward, as it neutralizes and limits the action of the acid. Chloracetic acid is used in about the same manner as chromic acid. N. H. Pierce, of Chicago, has suggested the submucous use of chromic acid, and Goldstein, of St. Louis, has suggested a special trocar and canula cautery-carrier for this purpose. The method consists in nicking the mucous membrane with a knife and carrying the trocar and canula between the mucous membrane and periosteum back to the posterior extremity of the inferior turbinate. The trocar is then removed and the chromic acid cautery-carrier is passed through the canula, and, as the canula with the cautery-carrier is removed, the chromic acid acts upon the submucous tissues. The galvano-cautery is used in the same class of cases as the chemical agents, and should be used in the same manner. The galvano-cautery is a most valuable agent, which, unfortunately, has been much abused. The disfavor into which the galvano-cautery has fallen is no doubt largely due to the fact that, through the faulty methods of its application, marked reactions were frequently excited, with profound constitutional disturbances. This was doubtless due to the method in vogue some years ago of going through the nasal chambers with long, linear cauterizations extending down to the turbinate bone. If a very finely pointed electrode is used and from four to six minute but deep cauterizations are made, the advantage is largely in favor of the galvano-cautery over the chemical agents. The galvano-cautery is less painful in application, with no after-pain.

This action can be more readily gaged, and there is no violent paroxysm of sneezing and headache. In favor of the chemical cautery is the simplicity of its application and the absence of any bleeding and the mild course of the healing process. When we have large redundant masses of tissue forming at the anterior or posterior extremities of the turbinates or hanging from the middle turbinate, or the free border of the inferior turbinate, the most efficacious and resultful method of procedure is their removal. This may be done through the use of either the hot or the cold snare. The hot snare is used by some in preference to the cold, because, through its cauterizations, it is supposed to occlude the venous channels and prevent hemorrhages. The objection to its use is that we have with its application a wounded surface, plus a burn. Through the introduction of suprarenal extract and its active principle, adrenalin, we need have little fear of annoying hemorrhage with the cold snare, and its use leaves a perfectly clean-cut wound, that heals kindly, thus making it preferable to the hot snare. Occasionally we have large pendulous growths of hypertrophied tissue along the free border of the inferior turbinate and large infiltrated middle turbinate, the former filling out the inferior meatus and the latter coming in contact with the septum or making firm pressure thereon. The only operative intervention that will effectually reduce this form of hypertrophy is through partial excision of the turbinate. Any of the various operative procedures of partial excision, as suggested by Kyle, Holmes, and others, are usually attended with most satisfactory results. I find the cutting away of the lower border of the inferior turbinate bone, just through the center of the downward curve, and throughout its whole length, in an anterior posterior direction, taking away as it does all the redundant tissue with a small margin of bone, and resulting in the formation of a linear cicatrix along the whole free border of the turbinate bone, thus giving a free respiratory space with sufficient turbinal tissue left to adequately carry out the physiologic function of the nasal chamber, to be the ideal operation. This operation can be performed with scissors and saws or swivel knife. In this operation pain is quite intense for a few moments, even under the most thorough local anesthesia; therefore, where a patient is of a nervous temperament or not very strong, it would be better to do the operation under a general rather than a local anesthesia. Suprarenal or adrenalin should be used quite freely on the mucous surface, whether the operation is done under a local or general anesthesia, until the tissues are thoroughly blanched. I usually prefer to do the operation with sharp, narrow, curved scissors; they make a clean-cut wound, the action is instantaneous, and the whole mass is removed at once. The excised mass, which is sometimes held by a shred of mucous membrane, is usually more easily removed by the snare than by any other method. After the removal of the mass the wounded surface should have immediately applied to it a pledget of cotton saturated with suprarenal extract or adrenalin, which is allowed to remain upon the wounded surface for five or ten minutes. This should then be removed and the whole wounded surface should be painted over with collodion. The action of collodion when so applied in preventing hemorrhage is remarkable. From the results I have seen from complete turbinotomy, I am rather opposed to its application as a surgical procedure in any form of chronic rhinitis. Occasionally we have large, dense hypertrophies which have been vainly attacked again and again by cautery agents, but they recur. The method of partial excision given above almost always gives complete relief in these cases. We find also that in many cases of hypertrophic catarrh the condition is maintained by other conditions within the nasal chambers, such as spurs from the septum or deflections. When these conditions exist, they should be carefully considered, and the relation they have to the existing chronic catarrh thoroughly studied. If the spur is well placed anteriorly, so as to cause more or less obstruction of the nasal chambers, its removal is essential for the correction of the chronic rhinitis; or, if there is a spur situated well back which impinges either upon the middle or inferior turbinate, indenting itself into their substance, it is essential for the correction of the catarrhal condition to remove them. Deflections which cause impairment to respiration through either nasal cavity also require correction, and their elimination as factors will correct very frequently the hypertrophic catarrh, without further treatment. Adenoids and marked hypertrophy of the faucial tonsil as well as myxomatous growths should receive appropriate treatment when they exist. In summing up the treatment of chronic rhinitis, I should state that due regard should be given to the causative factors, and these should be removed when practicable. Due attention should be paid to constitutional condition, habits, and hygienic surroundings of the patients, and local treatment should be instituted which will bring about the most satisfactory and quickest results. Overoperative treatment should be cautioned against, and local treatment instituted should be done under as thorough asepsis as possible.

Treatment of Atrophic Rhinitis.—Whatever line of local treatment is instituted, it is absolutely necessary that cleanliness form the primary and essential feature of the treatment. Thorough cleansing of the nasal chambers once or twice daily with an alkaline wash introduced by anterior and posterior injection until the solution comes through clear and free from crusts and secretion is very important. The solutions are introduced anteriorly by any of the various forms of nasal douches—preferably by those exerting only a moderate degree of pressure, and posteriorly by the post-nasal syringe. Patients should be thoroughly instructed in the use of these mechanical devices, and as to the danger of forcibly blowing the nose during the use of the douche. As the quantity of solution to be used is large, it is wise to select one which will accomplish good results without being very expensive. I know of nothing for this purpose that equals a normal saline solution. This can be prepared each time by adding a teaspoonful of salt to a pint of boiled water, or by making a solution from the nasal plasma tablets, to which I have before referred. Another solution which is very efficacious is one composed of one teaspoonful of the 10 per cent. solution of permanganate of potash to a pint of warm water. Boric acid may be used in the strength of from 1 to 2 drams to the pint of water. In the early stages of the cleansing it will be necessary to aid the action of the solution, on account of the density and firmness of the crusts, by the use of cotton-covered probes. Daily, or every alternate day, the patient's nasal cavities should be carefully cleansed by the attendant physician, and he should go over the whole mucous surface as thoroughly as possible with a cotton-protected probe, removing all crusts and pus from within the folds and duplicatures of the mucous membrane. Due caution should be observed, in using instruments for douching and sprays, to see that they are as simply contrived as possible, and that they are aseptically constructed and that they admit of sterilization. Various forms of local treatment have been suggested, mechanical and medicinal, according to the various theories that have been advanced as to its etiologic factors. Cleanliness and active irritation through the medium of irritative drugs are suggested by those accepting the view that it is the second stage of a purulent catarrh. Those adhering to the theory that it is an advanced form of the hypertrophic catarrh believe in curetting, galvano-cautery, and vibrato-massage. Gründwald and his adherents find diseased sinuses, open them up, and claim most excellent results. Those having faith that the condition is a trophoneurosis have resorted to interstitial electrolysis. In this connection it is well worth stating that those who have made use of electrolysis in the treatment of this disease have claimed most satisfactory results, but it has not gained many adherents during the last few years. Its application is so simple and so readily made, that I should strongly advise its use when permissible; the bacteriologists have suggested the various active germicidal agents—formaldehyd and bichlorid solutions. Among the various local mechanical agents that have been selected are tampons (Gottstein), use of curets, and the action of electricity. There is no doubt that the Gottstein tampon is a valuable agent in the treatment of this condition, especially in that class of cases in which, from various causes; frequent irrigation cannot be employed. The patient can be readily instructed in the making of tampons. They are made out of absorbent cotton rolled rather firmly, about 2 inches in length, and of sufficient size to just snugly fit in between the turbinates and the septum. The tampon should be well greased with an entirely non-irritating oil, but, better still, with a 25 or 50 per cent. solution of ichthyol. Where morning and evening cleansing is regularly resorted to, it is only necessary to wear the tampon from three to four hours daily in each nasal chamber. The use of this agent will not bring resolution, but, with thorough cleansing and the use of the tampon saturated with ichthyol, there will be marked diminution in crust formation and lessening of the offensive odor. I see no reason for the use of the curet or galvano-cautery as part of the routine treatment, and should strongly advise against their use. I have not much faith in vibrato-massage, as instituted by Braun. It is still strongly advocated by many of his adherents. It may be used by hand or motor. In this country Shurly, Price-Brown, and Bishop claim excellent results from its use. Among the local remedies now being used, and seemingly accomplishing more or less good in this type of catarrh, may be mentioned formaldehyd, which may be used in the strength of 1 : 5,000, gradually increasing the strength as it becomes bearable to the patient. This should be used after thorough cleansing of the nasal chambers either by an atomization into the nasal chambers, or by saturating pledgets of cotton with the solution and allowing them to rest in the nasal cavities for a few minutes, when they should be removed. Stearate of zinc, to which is added 15 grains of powdered nitrate of silver to the ounce, insufflated into the cleansed nasal chambers, should not be used more frequently than every third day. Both of these agents are stimulating and cause more or less pain. Menthol is extensively used, alone or in connection with camphor or iodin, in atrophic rhinitis. There is no doubt that this is an excellent protective and an exceedingly pleasant agent after the nasal chambers have been thoroughly cleaned out; nevertheless, I cannot view its use in this condition except as aiding and abetting the progress of the disease, and, therefore, would advise strongly against its use. In ichthyol we have an agent which, when used in connection with the cleansing and tamponing, gives results which are far superior to any other form of treatment with which we are at present conversant. At first the ichthyol should be used in 15 per cent. solution, rapidly being increased in its strength until it can be borne in 75 per cent. solution, or to the full strength of the drug. The drug should be thoroughly instilled into every portion of the nasal chamber that can be reached by the agent, at least every second day. The Finsen rays have also been used in the treatment of this condition. Whether the further use of this agent will prove that, like very many of the agents which have been introduced for the alleviation of atrophic rhinitis, it will have only ephemeral use, or whether it will prove of sufficient merit to become permanent in the therapeutics of atrophic rhinitis, it is yet too early to decide. Summers, of Philadelphia, claims great success in the lessening of crust-formation and diminution of odor by the use of insufflations of a 25 per cent. powder of citric acid in sugar of milk. Paraffin has also been employed in submucous injections into the turbinal bodies as a therapeutic resort. Careful examinations should be made in all cases of atrophic rhinitis for diseases of the communicating sinuses. Wherever these sinuses are found to be diseased, they should be treated in the manner indicated for these conditions. The antitoxin of diphtheria has been used in treating this disease, without any permanent results. Massolin has also been used in atrophic rhinitis with good results. In the management of all cases of atrophic rhinitis there is one feature that should strongly impress itself upon the therapeutist, and that is the need of radical constitutional treatment. I have never seen a case of atrophic rhinitis in which the individual possessing it did not impress me as one who was constitutionally below par. All the hygienic surroundings need looking over and correcting whenever at fault. These people should be housed, fed, bathed, and clothed as well as is consistent with their ability to provide. They should, unless necessity forbids, live as much out of doors as possible. Occasional changes of climate and surroundings exert a decidedly beneficial influence. The correction of disordered conditions of the alimentary canal is very potent for good, especially in regard to the habit of constipation, which is so prevalent among this class of patients. It is also found that these patients improve more rapidly under a treatment that includes some of the following constitutional agents, namely: iron, iodin, arsenic, cod-liver oil, or hypophosphites.

ACUTE LARYNGITIS

Acute laryngitis is an acute inflammation of the mucous membrane lining the larynx. The intensity and severity of the inflammatory changes vary greatly, being somewhat influenced by etiologic causes. We have the simple type of acute laryngitis, the rheumatic laryngitis, the laryngitis sicca, the hemorrhagic laryngitis, the catarrhal epiglottitis, and the laryngitis hypoglottica. The last form of laryngitis mentioned above, the acute laryngitis hypoglottica, is of sufficient importance to merit a few words in definition. This form of laryngitis occurs most frequently in children as the result of a severe simple laryngitis, or as a sequence of the acute exanthemata. It is characterized by croupy cough, marked impairment of the respiration, with inspiratory and expiratory stridor, and with little or no alteration of the voice. When inspection can be had, the characteristic infiltration of the subchordal portion of the larynx makes the diagnosis easy. The children do not evidence the depression shown in laryngeal diphtheria, and cultures, when made, give negative results. The acute laryngitis is apparently a non-infectious disease. The prognosis is always good. Restoration to the normal under appropriate treatment is always attainable.

Treatment.—As an acute laryngitis is frequently the sequel of an acute coryza, and nearly as often precedes the invasion of an acute coryza, both being frequently dependent upon the same causative agents, the same general line of treatment should be adopted in the prophylaxis and constitutional treatment to abort and lessen the severity of an acute laryngitis, as has been indicated in the chapter devoted to the treatment of acute rhinitis. The administration of aconite in one-drop doses, every half hour until six drops have been taken, is very efficacious in lessening the severity of the attack and brings about a speedy restoration. Rest for the larynx is absolutely essential and should be insisted upon when the voice is at all altered. When the cough is annoying, as it frequently is during the stage of congestion, it can be allayed by the administration of codein in ¼-grain doses or heroin in $\frac{1}{12}$-grain doses, every four or six hours. The excessive irritability of the congestive stage, indicated by the sensation of dryness, soreness, and cough, can be frequently relieved by exciting secretion through the medium of pilocarpin given in $\frac{1}{100}$ of a grain dose. Rest in bed, even in the milder cases, aids materially in bringing about a quicker resolution; in the severer cases it should be insisted upon. As disturbed conditions of the stomach and alimentary canal are frequently the indirect sources by which this condition is brought about, they should receive careful consideration. The diet should be simple; the bowels should be kept well open. If the patient is detained in his room, the temperature therein should be maintained at about 70° Fahrenheit, and should be rendered moist, especially during the congestion period, by the generation of steam. The desired effect of steam may also be attained by the inhalation of compound tincture of benzoin, of which a teaspoonful is added to a pint of boiling water. Cold compresses or an ice-bag should be applied to the neck when there is much soreness or great discomfort is present. When cold is contraindicated, or for other reason cannot be applied, we may make use of counterirritation. Counterirritation may be gained through the use of mustard or tincture of iodin applied over the larynx and trachea from the hyoid bone to the middle of the sternum. If there is evident constitutional disturbance present, which may have a greater or less influence on the production and maintenance of the laryngitis, it should be actively treated. Therefore, the rheumatic and gouty diathesis, gastro-intestinal disturbances, syphilis, the acute infectious diseases, diseases of the heart, etc., should receive appropriate and careful systemic consideration. Whenever laryngitis is due to the irritation from dust, chemicals, etc., the patient should be protected from, or removed completely from, these sources of irritation. Local treatment forms an essential feature in the relief and restoration of many cases of acute laryngitis. Naturally, there is a difference of opinion in regard to the best and most satisfactory non-irritating method of making these topical applications. Some laryngologists make use of topical application through the medium of the spray, others with a syringe, and still others by means of the laryngeal applicator. When one possesses the necessary skill and the delicacy of manipulation to make applications with exactness and gentleness of touch, there is no question of the superiority of direct topical application over the spray or syringe. In the early stages of acute active congestion, edema, or hypoglottic infiltration, the use of the solution of suprarenal extract or adrenalin, repeated several times daily, lessens greatly the edema, the swelling, and the congestion of the mucous membrane. Where there is edema of the aryepiglottidean folds or infiltration of the epiglottis, the free administration of suprarenal should be made use of, or scarification should be resorted to. The astringent solution should not be resorted to until the stage of secretion is established. The silver salts, on account of their astringent and mild germicidal action, are the most favored. The silver nitrate should be used in from a 1 to 2 per cent. solution. The sulphate and chlorid of zinc are also used to meet the same indications in from 1 to 3 per cent. solution. Where dysphonia is a very distressing symptom, especially if the patient is a public speaker, singer, or one whose vocation requires the free use of the voice, I find that restoration is materially aided by absolute rest of the voice and by the use of the continuous current applied to the larynx.

I wish to impress upon my readers the importance of thorough cleansing of the nasal, pharyngeal, and laryngeal mucous membrane before making topical applications to the larynx. Whenever there is occlusion of the nasal chambers and inflammatory changes in the nasopharynx, they should receive, at the same time, local attention. In the acute laryngitis in children, especially in that class having recurring attacks throughout the cold season,—the "croupy children," —they should have their general hygiene looked after. The parents of these children should be carefully instructed how to clothe, to feed, to bathe these children, and should be instructed as to the amount and character of open-air exercise for the little patients. Children of this type flourish under the administration of iron, arsenic, and cod-liver oil. When attacks occur, the child should be kept in a well heated room in which steam is generated or in which lime is allowed to slack. It is well to open the bowels with a calomel purge in small divided doses. Internally should be given tincture of aconite in ¼-drop doses, combined with a stimulant expectorant, as:

℞.	Ammonii bromidi	gr. xv	(1.00)
	Ammonii carbonatis	gr. xv	(1.00)
	Tincturæ aconiti	♏viij	(0.50)
	Glycerini	ʒij	(8.00)
	Aquæ	℥ij	(62.00)

Sig.—Two teaspoonfuls every two hours.

Holt advises during the croupy attack:

℞.	Chlorali hydrati	gr. lxxv	(5.00)
	Potassii bromidi	gr. xlv	(3.00)
	Ammonii bromidi	gr. xxx	(2.00)
	Aquæ cinnamomi	℥ij	(62.00)

Sig.—Teaspoonful in water every twenty minutes until improvement takes place.

External applications in the form of stimulant embrocations applied to the chest and neck act very well. I prefer the official soap liniment for this purpose. When the paroxysms of difficult breathing are coming on, as indicated by the stridulous respiration, if the little one is aroused and given drafts of hot milk, the attack will be considerably ameliorated, if not completely aborted. Should stenosis become very intense, it may be necessary to resort to intubation. In laryngitis hypoglottica, the general plan of treatment as indicated above should be followed. In this condition the local spraying of adrenalin, the external application of cold, and depletion through the bowels are especially efficacious. The use of a 1 per cent. solution of silver nitrate to the diseased area, when possible, is exceedingly beneficial.

Should breathing become markedly embarrassed, it will be necessary to resort to intubation or tracheotomy.

CHRONIC LARYNGITIS

Chronic laryngitis is a chronic inflammation of the mucous membrane of the larynx, which is characterized clinically by more or less alteration of the voice and change in the secretion. The condition is most frequently of local origin, being due to frequently recurring neglected attacks of the acute type. It is also the result of pathologic changes in the upper air-tract. Systemic disturbances, of both infectious and non-infectious character, are often attended with chronic changes affecting the laryngeal mucosa. Improper use of the voice by professional singers, speakers, and "criers" is often attended with structural changes within the larynx. The prognosis of chronic laryngitis, with regard to restoration of function and reduction of the mucosa to the normal, is fairly good.

Treatment.—Above all, a thorough appreciation of the possible etiologic factors must be taken into consideration, and methods adopted to correct these must be instituted at once. If there is disease of the nose or nasopharynx, such as hypertrophies, disease of the sinuses, deflected septum, adenoids, diseased tonsils, or enlarged uvula, appropriate treatment should be adopted to restore these parts to the normal. Constitutional conditions which may have an influence in causing or maintaining the laryngitis should be treated. It is well to bear in mind that a chronic laryngitis may be the only manifestation of syphilis, and the earliest symptom of aneurism or pulmonary tuberculosis. Habits that are attended with persistent irritation of the larynx and that are prejudicial to improvement, such as the excessive use of condiments, tobacco, and alcohol, should be broken up. Ofttimes a change of climate from the seashore to the mountains, or from the mountains to the seashore, works great benefit. A few months spent at one of the well conducted sulphur springs, where a rigid regimen is carried out, often produces extreme benefit. Where the voice is markedly altered, sparing use should be made of it. Singers, actors, and public speakers should be counseled to abstain from the use of the voice in singing or in public speaking. It is much better if those individuals affected with chronic laryngitis, in which there is alteration of the voice, make use of the whispered, instead of the loud voice. Where the injury to the larynx is the result of the improper use of the organ, the greatest good can be accomplished by placing the patient under the care of a good elocutionist or singing teacher. In laryngitis with thyro-arytenoid interni paresis or fatigue, strychnin internally is of value. When the secretion is very profuse, the internal administration of benzoate of sodium in 10- to 15-grain doses three or four times daily is said to be beneficial. Local treatment is only of value in that it supplements and assists the restoration to the normal after the removal of the cause. The appropriate drugs may be applied through the medium of the syringe, the atomizer, or by a cotton-covered applicator. Unless one is possessed of the necessary manipulative dexterity to make the laryngeal application gently and accurately, it is much better for the operator and the patient to resort to the use of the atomizer or the syringe. When it is desirable to apply solutions to the supracordal portion of the larynx through the use of the atomizer, the patient should be directed to hold the tongue well out and sound *a*, as in making laryngeal inspection. When wishing to medicate the subcordal portion of the larynx and trachea, the tongue should be held as above directed and the patient should make deep inspirations each time the spray or solution is injected. Before the use of topical application to the larynx, it should be cleansed by the spraying of one of the alkaline solutions before indicated. Those agents which give the best results by atomization or direct application to the larynx are mild solutions of the mineral astringents. Drugs in powdered form should under no circumstances be used in the larynx. The mineral astringents should be used in aqueous solutions. The strength of the solutions, as indicated in most textbooks, is entirely too great. Ofttimes a 1 per cent. solution of silver causes great smarting that may last for hours. The solutions which give uniformly the best results in this disease are a 1 to 2 per cent. solution of silver nitrate, a ½ to 1 per cent. solution of chlorid of zinc, a 1 to 3 per cent. solution of sulphate of zinc, and a 3 per cent. solution of alumnol. The above solutions may be used for direct topical application on a cotton-armed applicator or for spraying through an atomizer. Great care should be exercised in not overstimulating the mucosa by too frequent application; every second day is sufficient. It will be frequently noted that, as the case progresses, it will be necessary to increase the strength of the particular drug which is being used. After making use of one of the astringent solutions for a time, it will be often found advantageous to change to another. In that unusual form of chronic laryngitis which is known as hypoglottica chronica, most frequently secondary to syphilis or tuberculosis, internal medication should be instituted to meet the general infection. When the embarrassment to respiration is not very great, the application of nitrate of silver in caustic solution, scarification, or the application of the galvano-cautery should be resorted to. When the embarrassment to respiration is marked and increasing rapidly, tracheotomy should be done. After tracheotomy laryngofissure, with excision of as much of the hypertrophied tissue as possible, may be resorted to. After healing of the laryngofissure, it becomes necessary to resort to the use of specially constructed tracheal tubes with laryngeal dilators, such as suggested by Duel and Chevalier Jackson, until the caliber of the larynx is fully restored. For many months after the removal of the tracheal tube it becomes necessary to occasionally pass a bougie or intubating tube. In the laryngitis sicca the same general line of constitutional treatment should be instituted as I have indicated in treating atrophic rhinitis; the administration of iron, strychnin, and cod-liver oil, and the proper care of the hygiene and diet. As terpin hydrate is supposed to have a specific action on the laryngeal mucous surface, it may be administered three or four times daily in 3- to 5-grain doses. The local treatment of atrophic changes within the nose and pharynx should not be neglected. It is of the utmost importance to thoroughly remove all crusts and scabs from the laryngeal mucous membrane by the spraying of an antiseptic alkaline solution into the larynx. As an aid to the dissolving of the crust and as a slight stimulant to the mucosa, inhaling the steam from boiling water to which has been added 5 grains of sulphocarbonate of zinc to the pint is of great benefit. I wish here to protest against the use of mentholated, oily solution by atomization in this type of inflammation. The only solutions that will be of any value in this condition are those which act as an intense stimulant to the laryngeal mucosa, through which action we hope to stimulate the degenerated glandular structure. The drugs which are employed for this purpose are chlorid of zinc and nitrate of silver in 1 to 3 per cent. solution.

EDEMATOUS LARYNGITIS

This disturbance is due to vascular changes in the laryngeal mucosa, by which there is an extravasation of serum from the vessels into the submucosa. The extravasation is more marked in those portions of the larynx rich in reticular connective tissue, as in the aryepiglottidean folds, the arytenoids, the false bands, and the epiglottis. The condition is produced locally through injuries to the larynx, ulceration, pressure of new-growths, and inflammatory conditions in adjacent organs. It is also associated with specific inflammatory processes, as in perichondritis, and, as a result of autoinfection, in the form of angioneurotic edema. The most frequent causes are those of a systemic origin, as cardiac, pulmonary, hepatic, and renal. Edema of the larynx is a most serious condition, not only giving rise to great discomfort and suffering, but frequently endangering the life of the patient. The prognosis is fairly favorable if prompt and efficient treatment is instituted. A fatal termination may supervene, despite all well directed efforts.

Treatment.—The most important feature of treatment of edema of the larynx is to relieve the threatening impairment of the respiration as speedily as possible. No means gives such prompt and satisfactory relief as multiple punctures of the edematous tissue. This puncturing of the affected area should be done under the guidance of the laryngeal mirror, and the punctures should only be made into the infiltrated tissue. Treatment should also be directed to the relief of the local, infectious, or systemic condition which is the underlying cause of the disturbance. The patient should have administered a brisk saline cathartic and a diaphoretic. It is well to apply cold to the neck in the form of Leiter's coil or an ice-bag. Suprarenal extract, or its derivatives, should be used either by topical application or through atomization every two or three hours. This agent, by toning up the vessels of the mucosa, lessens the leakage from them. A patient affected with this condition should be seen often and watched with great care. Should the respiration become more and more embarrassed, in spite of the treatment employed, or should the case prove so urgent when first seen as to threaten suffocation, immediate resort to tracheotomy should be made.

SPASMODIC LARYNGITIS

Under the treatment of spasm of the larynx we must consider that condition in which there is a more or less protracted spasmodic closure of the vocal bands, whereby there is a more or less complete arrest of the normal process of respiration. This condition varies from the slight spasmodic closure of the bands, not complete, in which there is only a momentary interference with respiration, to those marked cases in which there is a sudden and fixed closure, which endures until the patient becomes deeply cyanosed, even unconscious, before the relaxation takes place. The purely neuropathic cases are usually of the most severe character. This disturbance is of systemic origin, secondary to change in the upper air-tract or laryngeal mucosa, or to pressure exerted upon the laryngeal nerves in the neck. The paroxysm may be very severe, even to the point of impending dissolution; but usually with the supervention of unconsciousness the paroxysm relaxes. It is a condition which excites terror in the patient and those about him.

Treatment.—Spasm of the glottis in the adult follows from so many diverse causes that it is almost impossible to lay out any regular plan of treatment. The upper air-tract should be carefully gone over to determine if there exists therein any condition which through reflex action would maintain the disturbance. New-growths, spurs, deflections of the septum, adenoids, and other diseased conditions of these parts should receive attention. The laryngeal mucosa should be carefully tested to determine if the condition is maintained by a hyperesthesia of the mucous membrane. When this condition exists, the application of a 1 per cent. solution of nitrate of silver gives marked relief. When the condition is due to pressure, either from glands in the neck or from mediastinal growths, or to aneurism, the condition can only be alleviated by the spraying of a 2 per cent. solution of cocain and menthol, or some sedative and antispasmodic solution, such as one of tincture of benzoin with paregoric. Any general systemic or nervous disturbance existing should receive appropriate treatment. To correct the nervous instability and hypersensitiveness, we may administer bromid of sodium or potassium in 10- or 15-grain doses.

In children the paroxysms are usually more severe than in adults. Frequently the severity is so great that immediate measures must be taken to arrest the spasm. Placing a child in a hot bath, with the dashing of cold water over the face and head, is probably one of the most effectual methods; or the child, having the clothing loosened, may be placed in a semi-recumbent position with the feet in a mustard bath and have cold water dashed on the face and head. Plenty of fresh air should be admitted into the room. The application of a mustard poultice to the front of the neck and sternum is of great benefit. If there is tendency to persistence of the attack, it is well to administer morphin and atropin hypodermatically in doses proportionate to the age of the child. A paroxysm may also be arrested by making firm traction on the tongue, making the tractions rhythmic at intervals of about fifteen times to the minute. Local causes of the disturbance should be diligently sought after and removed. The stomach, if overloaded, should be emptied with an emetic, and it is equally good therapeutics to administer a brisk purgative. The state of the gums should not be overlooked. In the interval of the attacks, careful search should be instituted for the direct or reflex causes, and, when discovered, they should be removed. Many of these children are of the lymphatic, strumous, rachitic, or tubercular type. They have bad digestions, are usually improperly fed, and are badly clad. They often have adenoids, hypertrophied faucial tonsils, and enlarged cervical glands. The adenoids and tonsils should be removed. Cervical glands should be removed where enlargement is causing irritation. They should have appropriate general treatment to meet the indication, and their diet should be carefully regulated; they should have daily morning cold sponge baths, with friction, abundance of outdoor life, and sleep in well ventilated apartments.

LARYNGEAL PERICHONDRITIS

Under the term perichondritis we shall consider not only the infection of the perichondrium, but also of the chondrium, as the clinical separation of the one from the other is frequently difficult, and as pathologically it is shown that the infection of the one is more or less closely attended with the infection of the other. This condition is an infection, whatever may be the contributing factor to its production. Any one, or all, of the cartilages may be affected. The cricoid is affected most frequently, usually on the inner aspect of its posterior wall. The arytenoids are next in frequency of infection. They are usually affected unilaterally and frequently undergo necrotic changes. The above mentioned cartilages are most frequently infected secondarily to tuberculosis. The thyroid is much less frequently affected than the cricoid and arytenoid. This cartilage may be affected in either wing and on its inner or outer aspect. Trauma, typhoid, malignant growths, and syphilis are the most frequent contributing causes to infection of this cartilage. The epiglottis suffers less than the other cartilages. The infection of the epiglottis is usually secondary to tuberculosis or syphilis. The methods by which the avenues of infection are opened is usually through solution of the continuity, as in trauma; or through specific ulceration whereby the infective micro-organisms are conveyed directly to the perichondrium, as in syphilis, tuberculosis, and malignant growths; or by infective emboli, as in typhoid fever. Perichondritis is an exceedingly grave condition, however produced. That form occurring as the result of violence, exposure, or rheumatism offers the most favorable prognosis. When occurring secondary to tuberculosis, the prognosis is exceedingly grave, although the progress of the infection is very slow. The most favorable cases are those secondary to syphilis, provided not too great changes have already been made in the chondrium. Typhoid cases are exceedingly grave, not only as to the immediate welfare of the patient, but as to his future comfort, should he recover.

Treatment.—In infection of the cartilages, when the process is purely a primary condition, the indications are to be met as in treating infection, wherever present. Until there is indication of pus-formation, abortive treatment should be instituted. Blood may be extracted externally; cold should be used either in the form of Leiter's coil or an ice-bag externally; and ice may be allowed to dissolve in the mouth. As soon as there is evidence of pus-formation, whether the pointing is internal or external, a free opening should be made and the pus evacuated. Most frequently the pus-formation can be reached by external incision. The granulation formed over the perichondrium should be curetted away, softened cartilage should be freely curetted, and, when necrosed, it should be removed. In tubercular perichondritis and chondritis free curetment of the diseased area forms the most satisfactory treatment. After curetment, the wounded area should have thoroughly rubbed in a 50 to 75 per cent. solution of lactic acid every second or third day. Due attention should be had to the general hygienic, climatic, dietetic, and medicinal treatment of the tuberculous condition. In syphilitic perichondritis no time should be lost in bringing the patient completely under the influence of the iodids and mercury. The typhoid variety is an exceedingly serious type of perichondritis, as it is very rapid in its progress, produces great danger of suffocation, demanding early tracheotomy, and frequently terminates with marked deformity of the larynx, more or less permanently interfering with passage of the air through the normal air-tract. In all the above mentioned types of perichondritis the occurrence of great danger to life from suffocation may appear rapidly or gradually as a result of edema; infiltrations supracordal, but more frequently subcordal; fixation of the arytenoid cartilages, or as the result of bilateral abductor paralysis. When the above mentioned condition exists with marked impairment of respiration, tracheotomy should be immediately performed. After the process has subsided, special treatment must be directed to the restoration of the lumen of the larynx through the breaking up of adhesions and strictures by dilatation with bougies, intubation tubes, or specially constructed tracheal tubes.

TUMORS OF THE LARYNX

Neoplasm of the larynx may be divided, for convenience of treatment, into the two groups of benign and malignant growths. The benign growths are much more common than the malignant, in the proportion of five benign to one malignant. Among the benign growths we find the papillomata the most common, while next in frequency are the fibromata. The rarer benign growths are the cystomata, myxomata, angiomata, lipomata, and adenomata. The most frequently appearing malignant growth is the epithelioma. The sarcoma is a rarer form of growth, while the encephaloid is the rarest form of this group of growths appearing in the larynx. The observance of neoplasm in the larynx is not of such frequent occurrence at the present writing as was the case during the early laryngoscopic days. The decrease in the frequency of these growths is no doubt due to the fact that those conditions which contributed to the development of neoplasm are recognized early, and, through appropriate treatment, relieved before new-growths have had time to develop. Any portion of the laryngeal mucosa may furnish the site for a new-growth, but, as a rule, they are most frequently found upon the vocal bands. The greater majority of new-growths are supraglottic; very rarely are they subglottic. The benign growths are very frequently pediculated; the malignant are almost always sessilated. The papilloma, the most frequently occurring benign growth, appears in two forms: The multiple recurring papilloma, and the discrete or single variety. The multiple papilloma usually occurs sessilated; may affect any portion of the larynx, even the epiglottic area of the larynx; occurs most frequently in child life; and has a marked tendency to recur and undergo spontaneous cure. The discrete occurring papilloma displays, in common with the multiple, but to a less degree, the tendency to recurrence. The next most frequently occurring benign growth is the fibroma. This growth is usually attached to the vocal bands, although occasionally springing from the ventricular bands. Fibroma is quite frequently pediculated. Malignant growths are spoken of as intrinsic when they are confined solely within the framework of the larynx, and as extrinsic when they extend beyond the confines of the larynx. Malignant growths of the epithelial type are rarely observed in the larynx until after the fortieth year. Sarcoma is most frequently observed before the fortieth year of life. The usual seats of malignant growths in the larynx are the laryngeal ventricle, the ventricular bands, or the epiglottis.

Treatment.—The form of treatment applicable to benign tumors of the larynx is surgical; and that form of surgical treatment should be employed which offers the least danger to the patient, as far as life and the subsequent use of the voice are concerned. Laryngeal growths may be removed by endolaryngeal methods, or through external surgical procedures, as tracheotomy or thyrotomy. The endolaryngeal method, by which various forms of tubular or non-tubular forceps or cutting instruments and snares are introduced through the mouth into the larynx, under the guidance of the laryngeal mirror, offers the safest and surest method of removing most of the benign growths. One must not only be skilled in the use of the laryngeal technic of investigation, but must also possess nicety of manipulative dexterity in the management of laryngeal instruments in order to have any success in the removal of laryngeal neoplasm. Most patients require more or less training in the holding of the tongue and accustoming the pharyngeal muscles to bear the presence of the mirror. A few patients have such complete control of themselves that they can not only hold the tongue properly but also submit to the indefinite pressure of the laryngeal mirror. It is usually better, in all cases, to make one or two trial sittings with the use of the laryngeal sounds to gain control before a formal attempt is made to remove the growth. At the time of the operation the larynx should be well penciled with a 20 per cent. solution of cocain applied by means of a laryngeal applicator, and, at the end of a few minutes, it should be repenciled. At the second application, in the withdrawal, it is well to touch the lower pharynx and epiglottis. The proper instrument to meet the individual case should then be introduced into the larynx, under the guidance of the mirror, and the growth grasped quite close to its attachment and evulsed. When the growths are pediculated, they may be removed with the snare. When sessilated growths are attached to the free edges of the cords, the sharp forceps serve the purpose best. I believe, though, that the serrated forceps evulsing, rather than cutting, will give by far the best uniform results in all forms of benign laryngeal growths, wherever situated. The Dundas-Grant forceps are also an excellent all-round instrument for removing all forms of laryngeal growths, especially when attached to the free surfaces of the vocal bands. I do not believe, when the growth is thoroughly and well removed through endolaryngeal methods, that it is ever necessary to cauterize the surface from which it has been removed. Growths will sometimes be removed piecemeal, but should, whenever possible, be removed *en masse*. The after-treatment should consist in absolute rest of the voice, until the results of the operation have entirely disappeared. Papillomata have a marked tendency to recur, not only at the site from which they have been removed, but from other previously unaffected portions of the larynx. Persistence in efforts is usually attended with relief. Multiple recurring papillomata occurring in children are usually best treated by performing a tracheotomy, and the removing of the growths through a tedious endolaryngeal procedure. The performance of tracheotomy for recurring papillomata in children, without other procedure, is frequently attended with a retrogressive metamorphosis of the neoplasm and complete restoration. Thyrotomy should not be done for this condition. Tracheotomy as a method of procedure may become necessary also in multiple recurring papillomata in the adult, as well as to reach subglottic growths. Thyrotomy may also be necessary to remove growths with too great an attachment to be possibly or safely removed endolaryngeally. I believe I have found the spraying of absolute alcohol into the larynx several times daily, as suggested by D. B. Delavan, to be of value in lessening the tendency to recurrence and causing atrophy of papillomatous growths.

Malignant growths should be treated by surgical removal of the neoplasm. When the growths are intrinsic, not too extensive in area, even though involving both sides of the larynx, they may be removed through a thyrotomy. The procedure in this type of operation is to do a thyrotomy without a trachectomy; the patient being in a moderate Trendelenburg position. After the splitting of the thyroid, and the cricoid if necessary, the two wings are pulled asunder and the mucous membrane of the larynx is touched with a pledget of cotton saturated with a 10 per cent solution of cocain, and then in a similar manner with suprarenal solution. The growth is then removed through subperichondrial dissection. The perichondrial dissection is carried beyond the range of the growth in all directions. The separated mass is then removed by scissors, appropriately curved. The wound is treated along the lines employed in treating a thyrotomy. If at the time of the operation the cartilage is found to be involved a partial or complete laryngectomy must be performed as the circumstances of the case may dictate. It is very questionable whether any operative procedure should be attempted upon malignant growths which are extrinsic and attended with marked glandular infiltration. It is almost impossible to determine the extent of the diseased infiltration through laryngeal inspection in malignancy, especially in the vertical direction. When operation is refused or cannot be performed, the suffering of the patient must be mitigated as much as possible. Locally pain can be much relieved by the use of orthoform, and the disagreeable odor lessened by the use of permanganate sprays. Morphin should be used as the exigencies of the case demand. When the breathing is much embarrassed, portions of the growth obstructing respiration may be removed endolaryngeally, or tracheotomy may be done. The *x*-ray, the ultraviolet rays, and radium may be used, but their efficacy is extremely doubtful.

SPEECH DEFECTS

By G. Hudson-Makuen, M.D.

The importance of speech as a factor in the mental and physical growth of our race is not generally appreciated. Speech has been defined as "A system of articulate words adopted by convention to represent outwardly the internal process of thinking"; but not only does it represent the process of thinking, but it is so closely interwoven with it as to be essential to its highest development. Speech is also one of the essentials to the highest physical development, for its use tends to expand the chest and aërate the blood. Deprive a man of speech, therefore, and you deprive him of one of the most important tools of the mind as well as one of the most important exercises of the body. The faculty of speech is presided over by delicate and complicated cerebral areas inciting to action, and working in harmony with, peripheral organs having other important bodily functions in addition to those of voice and speech production. Defective speech, therefore, having its origin in a defective action of some of these important central areas and peripheral organs, is a serious malady and deserves most careful consideration.

For convenience of study, we may divide these defects into two classes, and in the first class put all those cases in which the defect is the chief cause for complaint; and in the second, those in which it is merely a symptom of some more alarming condition, such as intracranial pressure from whatever source. The defects belonging to the latter class will be appropriately considered under the head of those diseases of which they are symptoms, and it is to the defects of the first class that attention will here be given.

It is convenient also to make two divisions of this class; and of the terms that have been used to designate them, the best are *dyslalia* and *pseudolalia*. Under dyslalia come those forms of defective speech in which there is *difficulty* of utterance, as, for example, stammering or stuttering; and under pseudolalia come all those defects of speech which may be characterized as slight deviations from normal speech, as the slurring or omitting of certain elements, and the substitution of one element for another.

STAMMERING (DYSLALIA)

Stammering is defective speech, characterized by a spasm of certain opposing muscles more or less closely related to the vocal or oral articulating mechanism. The spasm is not always confined to the muscles directly concerned with speech, but may extend to any part of the body, especially when great effort is made to overcome the defect. It is never exactly the same in any two cases nor does it always remain constant either in degree or in location, but it changes with the temperament of the individual. The phlegmatic person will sometimes merely stare at you and use no apparent muscular effort at all until such time as he thinks he may be able to proceed. This has been called the silent form of stammering, and in it there is but little noticeable spasm. In the majority of cases, however, the tendency is to at least try to speak, and the degree and extent of spastic muscular contraction will be proportionate to the effort put forth.

A muscular spasm, therefore, of greater or less intensity is the one condition that accompanies all forms of stammering. This muscular spasm is manifestly a result of misapplied energy in the effort to speak, and it has, to some extent, its counterpart in the grimaces of the letter-writer unused to the occupation, and in the muscular contractions of a beginner on a bicycle. To the expert, the control of a pen or a bicycle becomes automatic, and the nervous energy expended is almost nil; but to the beginner, the control must be voluntary, and the amount of nervous energy expended is out of all proportion to that which is required. So in the normal person, speech tends to become automatic and to require the least possible amount of nervous energy, but when something happens to interfere with the development of this automatic action of the organs of speech, and volition attempts to come to the rescue, the result is always more or less of a failure; there is a surplus of nervous energy expended, and this surplus overflows, so to speak, into muscles that may have but little to do with the process of speech production, the result being a spastic contraction or spasm of these muscles.

Moreover, the overflow takes place along the channels of least resistance, and as these channels vary in different individuals, the spasm does not occur in the same muscles in all cases, nor, indeed, in any two cases. It may occur in almost any part of the muscular system and its manifestation is oftentimes grotesque in the extreme.

The cause of stammering has given rise to much conjecture, and many superficial observers have supposed that they had discovered it—only to be disappointed upon further investigation. The mistake has been made of supposing that there is but one cause for the affection, and that it operates alike in all cases. The fact is, there are many causes, as there are many causes for dyspepsia or any other functional disturbance, and the precise or immediate cause in any individual case can only be determined after a careful and oftentimes prolonged study of the case.

Among the predisposing causes, heredity must be placed first. About 35 per cent. of the reported cases had relatives who stammered. It is an affliction that belongs to youth, and it begins at or soon after the time that the child begins to talk. It may continue into old age, but stammerers, as a rule, are not long-lived. Statistics show that about 84 per cent. of all cases seeking relief are males, and this would seem to indicate that sex must be regarded as a factor in the causation of the affection.

A nervous temperament, either inherited or acquired, is a condition common to most children who stammer. This condition may follow one of the infectious fevers or other diseases of childhood, or it may be the result of eye-strain, hypertrophied tonsils, adenoid vegetations, or intranasal pressure from whatever source. About 15 per cent. date the origin of their trouble to a severe nervous shock caused by fright or injury. One child had his head ducked in a tub of cold water and he has stammered ever since. Another was threatened with arrest by a policeman for playing "pussy" on the street. He was thrown into a convulsion and has stammered from that time. A child fell downstairs and received a slight injury attended by a great nervous shock, and stammering speech immediately followed.

Not only do glandular enlargements in the pharynx and intranasal hypertrophies and spurs act as causal factors in this affection indirectly, and in a reflex manner through the nervous system, but in so far as they interfere directly with the free automatic action of the muscles of vocalization and articulation must they be considered as direct causes. Moreover, we find decided evidences of arrested or imperfect development in the articulating organs of a large percentage of these cases. High and irregular palatal arches are more common than in persons having normal speech; bifid uvulas are of frequent occurrence, and we often find abnormalities in the various muscles of the tongue. A very large and badly shaped epiglottis was probably the cause in one of my cases.

In summing up this part of the subject, therefore, it may be said that anything that interferes with the uniform development and harmonious action of the various mechanisms of speech must be placed among the causal factors of stammering.

Treatment.—This brings us to the treatment of stammering. Here the old adage holds good, "An ounce of prevention is worth a pound of cure." Few children would become confirmed stammerers if they could have the proper treatment at the very inception of the trouble. Whatever may be the direct or exciting cause in any particular case, the child begins to hesitate in speech during a period of mental excitement. There is a confusion of ideas which leads naturally to a confusion of words and of the elements of which words are composed. It is here that the turning-point is made. Usually the child is either scolded or made fun of, either of which procedures tends to add to the confusion and to make future attempts at oral expression still more difficult. If we can tide the little patient over this period of nervous excitement, we shall in the majority of instances prevent the development of the affection. Most careful and gentle treatment should be employed, but any attempt at speaking should be interdicted until mental quietude has been fully established. A careful examination should be made with a view to discovering the cause of the trouble, bearing in mind that any condition that may add to the excitability of the patient becomes a contributory cause. Especially must we look for obstructions in the nose, the nasopharynx, and the throat. Careful examination of the mouth should also be made, and so far as possible any irregularities of structure should be corrected, glandular enlargements reduced, and the general health of the patient put in the best possible condition.

During all this time the child should be encouraged to talk but little, to think of only one thing at a time, and to express his thoughts with deliberation. The word "stammering" should never be used in his hearing, nor should his attention be directed in the slightest degree toward his speech, for the fear of future trouble is easily aroused, and this is one of the greatest obstacles to the accomplishment of a cure.

So much by way of prophylaxis! Now, what shall we do when the affection has become fully established and we find our patient utterly unable to speak without hesitation? The free automatic action of the various mechanisms of speech is no longer possible, and the patient is equally incapable of voluntary control of these mechanisms. He does not know how he learned to talk originally and he does not know how to overcome his present difficulties. Manifestly, the object to be attained is the re-establishment of the normal automatic processes of speech, and this can only be done, in the great majority of cases, by making use of voluntary control of the vocalizing and articulating muscles, and thus gradually but unconsciously leading the patient back to the normal processes of speech.

In these cases, also, the first step should be to try to discover the cause, and to remove it if possible. It is well to remember, however, that the original cause may have long since ceased to exist, and that only the results may remain. The stammering, for instance, may be the result of a nervous shock received years ago, or of an adenoid growth long since removed; so that the predisposing cause of the trouble may not be apparent at the time of the examination. If we can find any condition, however, that may in any way interfere with the harmonious action of the nervous system, our attention should be directed toward its improvement.

The general health of the patient, his diet and methods of life, should be carefully investigated and regulated. The organs of articulation and vocalization should be examined and an attempt made to correct any abnormalities, however slight they may be.

The vault of the pharynx must be examined and catarrhal conditions treated on general therapeutic and surgical principles. Nasal stenosis, while it may not be a common cause of stammering, undoubtedly serves as an obstruction to its cure, both by its interference with normal respiration and its reflex influence upon the nervous system. Intranasal obstructions and pressure, therefore, should be removed even though surgical procedures may be necessary.

Having corrected the patient's habits of life, both dietary and moral, and having removed so far as possible all other sources of nervous and physical disability; and having put the peripheral organs of speech in the most favorable condition for normal action, the after-treatment should consist in the development of voluntary control of certain important muscles employed in respiration, vocalization, and articulation. This can always be done with those who are at all susceptible to training, and it is the only scientific and rational means for the re-establishment of the normal automatic muscular action, upon which good speech depends.

Unfortunately, many stammerers are deficient in will-power, and in the faculty of attention, thus making it difficult to teach them this voluntary control of their muscles. They not only have trouble with their speech, but, to use an expression that is common among them, they "stammer in other things" as well. They do not think connectedly, nor do they pursue any line of action to its logical conclusions. These are the cases that are difficult to cure. The faculty of the will may be developed by training, just as any other faculty of the mind may be developed; and there are no exercises so efficient for this purpose as those required for the improvement and development of speech.

To gain voluntary control over the organs of speech, certain important muscles that have been considered hitherto as involuntary must be brought under the domain of the will. These muscles belong for the most part to the vocal and respiratory mechanisms. The management of the breath is faulty in all cases of stammering, and it is to this that attention should first be directed.

There is a certain definite and precise action of the great muscles in the lower thoracic and abdominal regions that is necessary to the production and control of voice, and this must be acquired by the patient before any real progress can be made or permanent improvement can take place. Just what the precise action of each one of these muscles is, has been the subject of much discussion, and its importance in connection with this work cannot be overestimated.

The respiratory muscles must be so used as to bring just sufficient breath upon the vocal cords, and no more than is sufficient, to produce the syllable or word that is required. Not only so, but the breath must come at exactly the proper instant for the production of the sound. A lack of promptitude in this respect is observed in many cases. The voice, the material of which speech is made, is not present or forthcoming at the instant that the oral mechanism requires it for articulation. The articulating organs try to perform their function, but there is no voice present to be articulated, and the result is a more or less spasmodic hesitancy. The patient dwells upon the initial consonant or repeats it until such time as the vocal mechanism may come to the rescue with the vocal element that is necessary for the completion of the syllable or word.

In other cases it is the oral mechanism that is at fault, and the patient dwells upon the vocal element and repeats it until such time as the articulating organs may be brought into action for the formation of the syllable or word. Suitable exercises must be given to make the action of these two mechanisms entirely harmonious, and this can be done by teaching the voluntary control of the various muscles of that mechanism in which the action is delayed; and then practising this voluntary control daily until the necessary promptitude of action is acquired.

In most cases it is necessary, for the exercise of this voluntary control, to have the patient speak slowly and in syllables. Alexander Graham Bell has said that syllabication is the cure for all vocal and oratorical defects. This may be claiming too much for the exercise, but it certainly should have a prominent place in the treatment of stammering. In many cases it is necessary even to divide the syllables into their component parts, and to drill the patient on these individual elements. Then, after a certain time, the elements that unite to form each syllable should be practised together and syllabic conversational exercises given, with careful attention to voluntary control over the important respiratory and phonatory muscles.

In all these exercises there should be an attempt to harmonize the various faculties of the mind, not only with one another, but with the exercises themselves. The patient should be induced to think introspectively and to study the impressions that the proper muscular action in the production of each syllable makes upon the mental and physical organisms. Not only should he be conscious through his sense of hearing that the syllable has been accurately given, but he should be taught to recognize, by means of the sense of feeling, the physical impressions made by the normal action of the muscles and the resultant vocalization.

The stammerer generally knows how the syllable would sound if properly given, but he has no definite knowledge of how it would feel to give it or what would be the physical and mental impressions. In other words, the mental and physical sensations of speech should be studied, and developed in what has been called the kinesthetic center of the brain; and after these sensations are recognized and felt, the patient should be taught to reproduce them.

PSEUDOLALIA

This brings us to the second division of our subject, namely, pseudolalia. In this division I would put all those defects of speech in which there is no spasmodic hesitation. The chief characteristic of this form is a defective or false utterance of certain syllables or words. In some cases there is a substitution of one element for another, while in others there may be an entire omission of the element. In one case reported by me there was a complete substitution of a language entirely unknown for that which the patient attempted to use, and not a single element of this false language had any resemblance to the element for which it was substituted. This is unusual, however, the majority giving proper utterance to at least one of the elements, and thus suggesting the syllable or word intended to be spoken. The first syllable in a word is sometimes omitted, and, as some one has said, the word becomes "decapitated." More often, however, the final consonant is not given, and the word becomes "decaudated"; and when all the elements are mispronounced, the word may be said to be "mutilated."

Mutilated speech is characteristic of imbeciles and idiots and all those having cerebral complications, but this paper, as has been said, deals only with those cases in which the defective speech is the chief cause for complaint, and in which there is fairly good cerebration. There is some defective cerebration, however, in all these cases, and therefore nice distinctions are not made in the utterance of the various elements of which words are composed. The auditory word center in the brain fails to recognize or to register accurately the exact sound produced by the peripheral organs of speech. No distinction may be made, for instance, between the physiologic sounds of the consonants D and G or T and K, the one being substituted for the other without any conscious recognition of the substitution; or one of these consonants may be omitted entirely and the ear fails to recognize the omission. Other cerebral areas may be similarly deficient in the performance of their natural functions, but the auditory center is often the only one affected. It must be remembered also that normal cerebral development depends very largely upon the use of the faculty of speech, and therefore that defective mentality, which at first glance seems to be the cause, may in reality be the result of defective speech.

Pseudolalia, like dyslalia, often has its origin in abnormalities in the structure of the peripheral organs of speech. The slightest irregularity in the organs of articulation may be responsible for the development of defects of speech in children. The shape of the hard palate, the dental arch, and the condition of the teeth all affect the character of speech. A short lingual frenum or any deformity of the lingual muscles not only causes defective speech, but may make the production of speech so difficult as to greatly delay its development, and thus interfere with the child's mentality. Enlarged faucial tonsils and adenoid vegetations in the vault of the pharynx have long been supposed to interfere in some mysterious way with the mental development of children; but, as I have pointed out elsewhere, they probably interfere with mental development only so far as they impair the patient's physical condition and obstruct the development of normal speech.

Another common cause of these defects of speech is the paralysis that often follows diphtheria and the various infectious fevers prevalent in children. This paralysis may be of only short duration, and yet if it comes during the formative speech period, it is sure to leave its deleterious influence.

It is during the earlier years of childhood that these irregularities in the peripheral organs of speech do harm; and although they may disappear after a few years, as is sometimes the case with hypertrophied tonsils, or be removed by surgical interference later in life, yet the defects of speech of which they were the direct cause remain as fixed physical and mental habits until they are corrected by suitable training. This is well illustrated by those cases having cleft palate. If the operation for the closure of the cleft be delayed until after the formative speech period, and until the peculiar speech characteristic of this condition be fully established, it will have little or no effect upon the speech, however well the deformity may be corrected. This fact would seem to indicate that it is not so much the cleft palate that causes the defective speech as the abnormal muscular action that is the direct result of the cleft palate.

Treatment.—In discussing the treatment of stammering we found that the object to be attained was the correction of a faulty coördination between the vocal and the oral articulating mechanisms; and indirectly, perhaps, between the muscles within one or the other of these two mechanisms. In pseudolalia the lack of coördination is entirely within the oral articulating mechanism. There is a faulty action in some of the muscles of either the lips, the tongue, or the palate; and whatever may be the cause of this faulty muscular coördination, there is always a corresponding defective action in the nerve-centers that preside over these mechanisms.

We must first make a careful physical examination of our patient with a view to determining the cause of the defect, always bearing in mind that this cause may have been operative only in the past and during the formative speech period. All structural peculiarities of the articulating organs should be carefully noted and any obstructive irregularities corrected or removed. When this is accomplished, muscle training should be given with a view to correcting the faulty action and establishing correct coördination. We often find a lack of uniformity in the development of these muscles, which may be corrected by suitable voluntary exercises entirely independent of speech. For instance, muscles of the lips or of the tongue that have been entirely involuntary may be brought under the control of the will and made to act independently of others, and thus be trained to perform their natural functions. This muscle training is an important factor in all speech defects, not only on account of its value in harmonizing the action of the muscles themselves, but also on account of the fact that it serves as a direct stimulus to the development of the cerebral areas that preside over the muscles; and the general mental development resulting from these exercises is sometimes very marked.

Following this muscle training should come exercises for the correction of the special defects that may exist in each individual case. Speech is voice articulated or molded into certain definite shapes or forms. The vocal mechanism furnishes the voice, and the oral articulating mechanism the molds, into which the voice may be regarded as being poured. Each syllable of speech requires a separate and distinct adjustment of the articulating organs, and those syllables that are composed of two or more primary elements require for their utterance certain variations in the molds. For instance, the syllable "m-a-t" has in it three primary elements, for each of which a separate mold is required; but in the utterance of this syllable the elements follow one another in such quick succession and close sequence, that practically only one variable mold is required, upon the structure and formation of which depends the character of the resultant product. If any part of the mold be defective in its formation, there will be a corresponding defect in the articulation of the syllable. For instance, if the first primary mold required for the physiologic sound represented by "m" be omitted, the syllable will be decapitated; and if the last one required for the letter "t" be omitted, the syllable will be decaudated, and if the three primary molds be improperly formed and coördinated, the syllable will be mutilated.

The decapitation, decaudation, and mutilation of syllables are phenomena that I have designated pseudolalia, and in the treatment of this affection we must teach the proper formation and coördination of the primary molds of speech and their coördination into what we have called the variable molds required for the utterance of syllables and words. To do this, one must have an accurate knowledge of the anatomy and physiology of the organs of speech and the action of each muscle; and he must be able to form a clear mental picture of the exact position of the organs of articulation required for the formation of the primary molds for the elements of speech and their coordination into the variable molds for syllables and words.

The patient must be taught the precise voluntary muscular action required for the formation of these molds. He must be shown, for instance, how to shape the lips and where to place the tongue for each element of speech in which he may be found deficient, and thus by frequent repetition of this voluntary control of the organs of speech he may be trained to speak automatically with great accuracy.

It will be observed, therefore, that the principle underlying the treatment of all defects of speech consists in the establishment of an accurate voluntary muscular control of the organs, this control to be continued until the faulty processes or habits of speech have been entirely eradicated and the new and improved methods become habitual and automatic.

BRONCHOPNEUMONIA — CHRONIC INTERSTITIAL PNEUMONIA—PNEUMOKONIOSIS—ABSCESS OF THE LUNG—GANGRENE OF THE LUNG—TUMORS OF THE LUNG

By Henry Jackson, M.D.

BRONCHOPNEUMONIA

Bronchopneumonia differs in many respects from lobar pneumonia. First as to etiology: in some cases the disease is dependent upon infection with the pneumococcus, and in this case represents usually a primary disease. In many cases, however, bronchopneumonia is a secondary disease, dependent upon infection of small areas of the lung tissue with the organism which has caused the primary disease. It is a common complication of measles, not rare in diphtheria, and occasionally seen in typhoid fever. It is essentially a part of, or at least a common accompaniment of, bronchitis of the smaller bronchial tubes, and an important factor in the causation of the bad prognosis of this type of bronchitis.

Bronchopneumonia is found in three classes of patients: first, as the usual type of infection with the pneumococcus in infants; second, in old persons; and third, in individuals much debilitated from any cause. It forms one of the common terminal diseases in cancer and various other forms of cachexia, from whatever cause.

Another and a most serious form of bronchopneumonia is found in general sepsis; the especial danger of this type of the disease lies in the liability of the formation of small multiple abscesses and areas of gangrene, due primarily to the nature of the infective organism, and secondarily to the type of patient in which such an organism is likely to be found.

A similar type is found in "inhalation pneumonia," which is found when particles of food have been drawn into the lungs during anesthesia, or when vomiting occurs in patients partially unconscious from any cause, as apoplexy, uremia, or cerebral injury.

In the two latter types mentioned, abscesses or gangrene are very likely to occur in the infected lung areas. Anatomically, the lungs appear enlarged, do not collapse, and usually contain much fluid from the coincident edema. The cut surface shows much edema, and small areas scattered over the surface, somewhat raised, reddish or gray in color, according to the age of the lesion inspected. In the same lung one usually finds several areas which are evidently of a different age; some fresh with a red color, others gray, in the stage of resolution representing the so-called gray hepatization.

As has been already stated, bronchopneumonia is not essentially due to infection with the pneumococcus, but many organisms are found as etiologic factors. The streptococcus is often found; in diphtheria and typhoid fever we may find the Klebs-Loeffler bacillus or the typhoid bacillus as the cause of the bronchopneumonia, or we may find that the disease in the lungs is due to various organisms connected with secondary ulcerative or necrotic processes associated with these diseases.

Bronchopneumonia is a common accompaniment of the late stages of pulmonary tuberculosis, dependent upon infection of the lung tissue with the organisms secondary to the destruction of the lung by cavity formation.

The course of this disease is as varied as is its etiology, and we may say that the general tendency of the disease toward death or recovery varies with the etiology. Bronchopneumonia, as seen in children, when due to the pneumococcus, and practically representing the ordinary pneumonia of infants and children, is not more, and usually less, fatal than pneumonia of adults.

When we find the disease associated with and dependent upon a wide-spread capillary bronchitis, it represents one of the most severe of the acute diseases with which we meet. Primarily, this form of bronchitis is seldom met with except in infants, usually debilitated by some previous pathologic process, or in adults already much reduced by some chronic disease. In adults we often find a bronchitis of the smaller tubes, with areas of bronchopneumonia in chronic alcoholic poisoning. Secondarily, when bronchopneumonia is added to an already extensive bronchitis, we find marked cyanosis with great embarrassment of the respiration, as practically no part of the lung tissue is intact. When such a combination is present, a bronchopneumonia added to an extensive capillary bronchitis, we have a pathologic condition similar to and almost as fatal as the dreaded pulmonary edema seen in the late stages of the ordinary lobar pneumonia.

Bronchopneumonia in typhoid fever is a serious complication, but far less than the same pathologic process dependent upon diphtheria.

In the late stages of many chronic wasting diseases we find bronchopneumonia occurring as a terminal infection, hence necessarily fatal.

When the disease is secondary to a general septic infection, we have added to the danger of the bronchopneumonia the liability of the formation of small areas of gangrene or the formation of multiple abscesses, a condition to be treated in a special section.

The Indications for and the Methods of Treatment.—(1) *Treatment Based upon Our Conception of the Morbid Process.*—As bronchopneumonia is in many cases a secondary pathologic process, we consider first the possibility of checking the primary disease. In one disease, diphtheria, we have that power in our hands; namely, by the early and thorough use of diphtheria antitoxin. Since the introduction of this treatment of diphtheria, based on absolutely proved scientific data, the occurrence of bronchopneumonia is far less common than in preceding years. Except in this one disease, we cannot at present offer any direct proof of our ability to check the infection of various organs of the body by micro-organisms.

(2) *Treatment Based upon Certain Predominant Symptoms.*—As bronchopneumonia is always a debilitating disease, it is of the utmost importance to maintain the strength of the patient in all possible ways. The patient should be placed in a large, well ventilated room; in warm weather the patient should, if possible, be out of doors. In cold weather, and especially in damp weather, the patient does better in a room artificially warmed.

The extreme cold of our northern climate, which acts favorably on so many of our cases of lobar pneumonia, does not seem suitable to cases of bronchopneumonia. This is probably due to the fact that most cases of bronchopneumonia are met with in patients already debilitated, and perhaps because of the association of diffuse bronchitis, and often of bronchitis of the finer tubes.

The most nutritious food is necessary. We should attempt to give, not only as much food as is required by patients in health, but even more food when the digestive powers are not impaired. To obtain this end, we can often in children add oils to the diet—sweet oil, cod-liver oil, and butter in quantities as large as can be given with bread. The meals must be frequent in number, as the quantity taken at a single meal is often small.

As the quality and quantity of the food are the essential factors in aiding recovery, we must carefully avoid giving various so-called expectorants, which may impair digestion.

One drug I wish to mention, as I consider it of a good deal of value, in the treatment of the associated bronchitis; namely, terpin hydrate, either alone or combined with small doses of codein. Cough is usually a symptom more prominent in bronchopneumonia than in pneumonia, and when excessive, or when it prevents sleep, may form the one factor in the disease which demands our attention. If the cough is present only when the patient raises some sputum, it is not wise to attempt to check it, but a frequent, harassing cough must be checked in order to prevent loss of strength.

In the first place, especially in children, give careful attention to the position of the patient in the bed. Raise the child by the use of several pillows, which must thoroughly support the body. If the patient be quite sick, give instructions to the nurse to change the position in the bed frequently, in order that one side of the chest may not be unduly compressed by lying long in one position. In some cases a swathe applied fairly tight about the chest gives much comfort and prevents frequent coughing.

When the various mechanical devices suggested fail to give relief, resort must be had to the use of opiates; in small and appropriate doses opium does not depress the heart action, and apparently favors recovery by preventing the spread of the existing bronchitis.

Preference should be given to the derivatives of opium, heroin or codein, or to the old remedy, Dover's powder. In no case is even a mild degree of narcotism permissible; first, because opium in such doses acts as a cardiac depressant, and second, because of the danger due to the collection of fluid in the bronchi, from the total suppression of cough. If pulmonary edema comes on, as shown by the character of the râles heard and the wide-spread area of the râles, and by a commencing duskiness of the features, two methods may be tried: remedies to increase the action of the heart, as digitalis and strychnin, and atropin in doses sufficient to produce slight dryness of the throat.

(3) *Treatment Based upon an Examination of All the Organs of the Body.*—In bronchopneumonia we have first to consider the effect of the disease upon the heart. Especially in old people do we derive benefit from the use of cardiac stimulants early in the disease, before any dilatation of the heart has taken place. Such an indication is best met by giving one or two doses of digitalis in the day, and the routine use of moderate doses of strychnin from the first if the disease be serious or the lesions wide-spread. In children sweet spirits of niter serves a useful purpose, chiefly from its action upon the kidneys and the reduction of temperature.

In bronchopneumonia we find much less tendency to a spread of the disease to adjacent serous membranes. Endocarditis, pericarditis, and pleurisy are far less common than in pneumonia.

We must always remember the danger of permanent damage to the lungs from chronic bronchitis, or from the infection of the diseased area of the lung with the tubercle bacillus. Hence, in bronchopneumonia the patient demands greater care in convalescence than after lobar pneumonia. When possible, the patient should be sent to some dry, healthy place in the country, where a prolonged stay out of doors favors absolute recovery.

CHRONIC INTERSTITIAL PNEUMONIA

A chronic interstitial disease of the lung is found in two types: as a local affection, and as a process affecting a large part or the whole of a lobe. The first type, local interstitial disease, is essentially a conservative type, very common, found where nature has attempted to wall off an area of disease. It is found most frequently at the apices surrounding an area in which there has been a small focus of pulmonary tuberculosis. The same pathologic condition is found surrounding tissue in which there has been a small abscess cavity or a local injury from any cause. A subvariety of this type is the more extensive interstitial disease found in pneumokoniosis, the result of the inhalation of fine particles of dust. This type forms the disease pneumokoniosis.

These types mentioned represent not so much a disease of the lungs, as nature's effort to obliterate a disease. They are conservative and do not give rise to symptoms.

The lobar type of chronic interstitial pneumonia represents a very different disease; in this form we find a growth of interstitial tissue invading and destroying the parenchyma of the lung. Etiologically, the process may be the end-result of a pneumonia in which resolution has not taken place. There has been an organization of the exudate in the lung, instead of an absorption, with a massive growth of the interstitial substance of the lung. Or the disease may be the so-called "pleurogenous" type, in which the process in the lung is the direct result of a growth into the substance of the lung from a fibrous inflammation of the pleura.

The pathologic results of the interstitial disease are obliteration of the parenchyma of the lung, dilatation of the bronchi, often with the formation of cavities of considerable size, and a compensatory enlargement with emphysema of the sound lung.

A difference of opinion exists as to whether this interstitial pneumonia follows an ordinary acute lobar pneumonia, or whether the process is, from the first, a subacute disease of a different type.

Clinically, the disease is essentially chronic; the chief symptoms are shortness of breath on exertion, cough, and often profuse expectoration from the accumulation of purulent material in the dilated bronchi. The disease probably represents one type of what the older writers spoke of as chronic phthisis, the so-called "forty years' consumption" of the laity.

The diagnosis is usually made easy by the shrinkage of the affected side, with compensatory enlargement of the sound side. The heart is often drawn to the affected side, and its outlines made obscure by the emphysema of the sound side. The resonance is often dull and auscultation shows signs of chronic bronchitis over the diseased lung.

This disease must be differentiated from a similar pathologic condition, due to infection with the tubercle bacillus, the so-called fibroid phthisis.

The disease, true chronic interstitial pneumonia, not due to a chronic type of tuberculosis, is, in my hospital and private practice, a rare condition.

The Indications for and the Methods of Treatment.—(1) *Treatment Based upon Our Conception of the Morbid Process.*—It is improbable that any treatment is of avail to cure chronic interstitial pneumonia. Our endeavors should be directed to prevent a secondary subacute or chronic bronchitis, to which patients with this disease are very liable. To this end, when practicable, patients should live in a high, dry climate where they are protected as well as possible from dust. One of the dangers of chronic interstitial pneumonia is emphysema of the sound lung, therefore patients should be warned against forms of employment or exercise which induce violent breathing. When the process is extensive, respiration is rapid and difficult, so that the most quiet life should be sought for.

(2) *Treatment Based upon Certain Predominant Symptoms.*—The most prominent symptoms we have to combat are due to a secondary chronic bronchitis, and to the pseudo-cavities produced by dilatation of the bronchi.

Here we practically treat the chronic bronchitis. Where the cavities are of considerable size, there is often decomposition of the contents, as in small abscess cavities, hence the methods of disinfection as suggested in the section on abscess of the lung are indicated.

PNEUMOKONIOSIS

This disease differs essentially from other forms of acute and chronic lung diseases in that its cause is a purely physical disturbance of the lung tissue. The etiologic factor of the disease is the inhalation of dust in varying forms and of different character. The fine particles of dust are by the lymphatics carried to the bronchial glands and to the fibrous structures which surround the alveoli of the lungs, and also find lodgment in the cells which line the bronchi and the alveoli of the lungs. These particles of dust may be coal-dust, as in miners, bits of fine steel or iron, as in those who grind metals, pulverized stone in the case of stone-cutters, and occasionally fine bits of grain; hence we have the various subdivisions of pneumokoniosis, as anthracosis when due to coal-dust, siderosis when due to metallic dust, and chalicosis in the stone-cutters.

The pathologic condition, pneumokoniosis, represents a condition which differs from the normal adult lung only by the excess of the foreign matter deposited in the lung.

A moderate amount of dust may be deposited in the lung tissues without giving rise to symptoms. Pathologically we find two factors of importance; namely, a chronic bronchitis due to mechanical irritation, and a condition of emphysema usually associated with late stages of this disease. The growth of the interlobular fibrous tissue may be so great as to give rise to areas of cirrhosis or fibroid degeneration of considerable size.

In the cirrhotic areas the circulation may be so cut off that we find small abscesses from the breaking-down of the lung tissue.

Such is the pathologic process which is a common cause of the so-called "coal-miners' phthisis." As tubercle bacilli often find a favorable nidus in other forms of chronic pulmonary disease, so in this process, as a late complication, tubercular disease may be added to a long existent chronic pneumokoniosis. The disease is essentially chronic, and the prognosis depends upon the extent and character of the secondary chronic bronchitis and emphysema, except in those cases in which a tubercular process is added to the original disease.

The Indications for and the Methods of Treatment.—(1) *Treatment Based upon Our Conception of the Morbid Process.*—As this disease is essentially mechanical in its etiology, due to a perfectly definite factor, treatment lies in prevention, not in cure. When possible, proper ventilation should be supplied in mines and in workshops filled with fine dust; this is the main factor, as it is practically impossible for workers to wear masks sufficiently fine in the mesh to prevent inhalation of the finely pulverized coal, iron, or stone dust.

(2) *Treatment Based upon Certain Predominant Symptoms.*—The

essential symptoms of this disease are due to the secondary chronic bronchitis and emphysema, and the treatment is that suitable to such conditions.

ABSCESS OF THE LUNG; GANGRENE OF THE LUNG

Abscess of the lung is a secondary disease, dependent upon infection of the lung substance in most cases by some of the pyogenic organisms. Generally the primary disease is a bronchopneumonia; in other cases the primary disease is found in an acute endocarditis of the right heart, or the abscesses are dependent upon a general septicemia, due to a subacute or chronic suppurative focus in a distant part of the body. We may, rather rarely, find a large, single abscess cavity in the lung as the end-result of pneumonia.

Abscesses in the lung are usually multiple and small in area. The physical signs produced may not differ from those produced by a bronchopneumonia, in that the abscesses are so small in area that percussion gives rise to no dullness, and auscultation does not show bronchial respiration. When one or more of the abscesses are of large size, we may find small areas of tympanic note with amphoric respiration.

When the abscesses are multiple and of small size, the diagnosis is usually made only post mortem. But the chief and most characteristic sign is the occasional expectoration of large quantities of pus, often foul in odor—a sign, however, only when the abscess cavity is of considerable size.

Abscesses in the lung are found in two classes of cases: first, in patients of low vitality, in whom reparative processes are feeble; and, second, in cases in which the original areas of bronchopneumonia were due to infection of the lung by septic organisms, as in general septicemia, and in the special type of septicemia, a malignant endocarditis, which involves the right side of the heart.

From the nature of the disease, the prognosis is necessarily grave; further, the situation of the abscesses is important in that a single abscess of the lung is rare; as a rule, we find multiple small abscesses scattered through the lungs in an individual whose ability to resist a chronic suppurative process has been much reduced by a serious general septicemia.

When a single large abscess is found in the lung, the prognosis is rather less grave. Such an abscess is usually a rare terminal result of lobar pneumonia; this termination of pneumonia is not found in individuals whose previous health was good, but clinical records suggest that such cases do recover under proper medical supervision, and this is the form of abscess that offers the only hope of cure after surgical intervention. A typical case of this form of abscess has recently been under my care; a boy of ten years was admitted to the hospital for severe abdominal pain, supposed to be appendicitis. As the respiration was rapid, the temperature was high, and there was no definite abdominal spasm, operation was postponed. Pneumonia developed in the left lower back. After a preliminary crisis there was fever for several weeks; the signs suggested empyema, but aspiration failed to show pus; pus was expectorated in large quantities and the boy recovered absolutely.

An examination of the postmortem records of the Boston City Hospital shows the following facts in thirty cases of abscess of the lung:

Multiple abscess	20
Single large abscess	8
Healed abscess cavity	2

That is to say that multiple abscesses were found in two-thirds of the cases, and in these, operation could not have been of any value. In one of the cases with a single large abscess the chest had been incised and the patient lived two months after the operation. The patient had chronic pulmonary tuberculosis, fell overboard while drunk, and was operated upon three weeks later.

As to etiology, the following facts are of interest:

	Cases
Pneumonia and empyema	9
Bronchopneumonia without definite cause	3
Chronic pulmonary tuberculosis	4
Disease of ear associated with scarlet fever	3
Local septic condition in abdomen	8
Multiple injuries from accident	1
Two cases healed abscess	2
	30

In the two cases reported as "healed," in one doubt was expressed by the pathologist whether the preceding trouble was an abscess of the lung, but this leaves one case in which a spontaneous cure probably took place.

A bacteriologic examination in seven cases showed in five staphylococci, and in two streptococci with pneumococci.

A review of these cases shows that the prognosis of abscess of the lung is bad, in that the pathologic condition was such that repair could hardly be considered as possible.

Further, a review of thirty cases in the medical records, in which the diagnosis of abscess was made, though not proved, shows:

Died	19
Discharged not relieved	4
Discharged relieved but not cured	7

Gangrene of the lung etiologically does not essentially differ from abscess of the lung; in most cases of abscess there is more or less decomposition of the contents of the abscess cavity; this gives the excessively foul odor usually found in abscess and always present in gangrene.

There is no other disease except ozena which gives the foul, penetrating odor found in gangrene of the lung. A large ward is often extremely unpleasant in odor from the presence of a single patient who suffers from this disease.

In gangrene the destructive process usually involves large areas of lung tissue surrounding the original focus, until a whole lobe may be transformed into a foul gangrenous mass, in which is found only shreds of lung tissue, bathed in the foul pus which forms the chief part of the former lobe.

When the gangrene is limited to a very small area, as occasionally seen in pulmonary embolism, the prognosis of gangrene of the lung is practically hopeless.

The Indications for and the Methods of Treatment.—(1) *Based upon Our Conception of the Morbid Process.*—Abscess and gangrene are essentially diseases found only in patients with marked reduction of the general strength or with serious involvement of the circulation. We find these diseases in the young, poorly nourished child; further, in the aged, in whom, in addition to the debility associated with advancing years, we have in arteriosclerosis deficient local blood-supply. Hence in these two classes of individuals we meet the necessity of improving the general condition in all acute pulmonary conditions, and especially in lobular pneumonia. Our efforts should be especially directed to giving as much food as the patient can digest. The bedroom should be large and well aired.

Especially in the aged should attention be given to the action of the heart. When the heart is feeble, digitalis is especially indicated, and perhaps other cardiac stimulants, as strychnin. My hospital experience leads me to feel that digitalis is a valuable aid in chronic pulmonary affections of the aged. As mentioned in the treatment of bronchopneumonia, a frequent change of the position of the body is advantageous, especially in the very feeble, who are inclined to be absolutely still in one position, partly from weakness and partly because such an attitude favors lessening of the cough. Further, in the same line of treatment, opiates in doses sufficient to prevent cough should not be given.

(2) *Treatment Based upon Certain Predominant Symptoms.*—Two factors are of the greatest importance as symptoms: expectoration of a large amount of pus and the foul odor of the pus.

Practically, first, should be the addition of a deodorizing substance to the sputum-cup, as a solution of chlorids, permanganate of potash, or a 5 per cent. solution of carbolic acid. Such measures not only make the patient less obnoxious to others, but relieve him of the foul odor arising from his own sputum-cup.

Second, the attempt to prevent decomposition of the pus in the lung cavities. This indication is best met by the inhalation of creasote, guaiacol, carbolic acid, and turpentine. The patient may wear constantly by day, and often by night, the tin respirator introduced by Beverly Robinson; the cotton in the inspirator should be moistened with a mixture of equal parts alcohol, creasote, and spirits of chloroform. Such a treatment not only greatly alleviates the foul odor, but tends to lessen cough, and probably is the best method medically to hasten a cure of the local process.

Internally, we may use guaiacol, creasote, and turpentine in drop doses several times daily; begin with doses of 5 drops and increase gradually to 10 drops three or four times a day.

TUMORS OF THE LUNG

Cancer.—Cancer of the lung may be primary or, as is usually the case, secondary to disease in some remote organ, or due to extension by direct invasion through the pleura from the breast. During the last thirteen years eighteen cases of cancer of the lung have been recorded in the pathologic department of the Boston City Hospital; four of these cases were primary cancer of the lung.

In all of the hospital cases of primary cancer of the lung, and in one seen in private practice, the tumor was large, easily demonstrable as an area of consolidation in the lung, and usually accompanied by pleural exudate, bloody in character. This disease may be so rapid in its course that the consolidation is considered clinically dependent upon pneumonia or bronchopneumonia.

Secondary cancer of the lung is far more common than primary cancer. In fourteen hospital cases noted in the pathologic department the primary disease was situated as follows: breast, four cases; prostate, three cases; pancreas, two cases; liver, neck, kidney, one case each; and one of multiple "malignant adenoma" of all organs.

In many cases of secondary cancer of the lung the disease is present only in the form of small discrete nodules which give rise to no symptoms during life and practically are of no importance. Cancer of the pleura and lung is by no means a rare cause of death as a late result of cancer of the breast. In these cases the pleural exudate is usually large and the tumor of the lung of such size that it is easily demonstrable as an area of consolidation. Pain in the side dependent upon pleurisy is a most suspicious sign in patients who have had a cancer removed from the breast. The course of cancer of the lung due to direct extension from the breast is usually rapid, death supervening in from two to six or eight weeks, though life may be prolonged for a year.

Secondary cancer of the lung is not an uncommon complication of cancer of the bladder, prostate, or ovaries without signs or symptoms of involvement of the abdominal organs other than those primarily diseased.

In differential diagnosis we have to consider chiefly bronchopneumonia in the acute form of the disease and tuberculosis in the chronic form.

Sarcoma.—Sarcoma may be found as a primary or as a secondary disease. It is far more rare than cancer. The disease may run so rapid a course as to be mistaken for acute pneumonia or acute pleurisy, as in the case of a man previously perfectly healthy who was admitted to my ward for pneumonia, was tapped in a few days on account of a large bloody pleural effusion, and died in ten days of an acute sarcoma of the pleural cavity and lung. In all forms of malignant disease of the lung a pleural effusion is usually bloody, often resembling pure blood on aspiration. The diagnosis of the cause of the pleurisy can usually be made by the finding in the fluid of cells characteristic of sarcoma or cancer. Four cases are recorded in the pathologic records of the hospital in the last thirteen years: three of multiple small tumors scattered through the lung which clinically gave rise to no marked symptoms, and one of a massive tumor of the whole chest cavity diagnosed during life as "sarcoma of the chest." All these were secondary tumors.

In addition, there were several cases of massive tumor diagnosed by aspiration which were not examined post mortem.

Indications for and the Methods of Treatment.—(1) *Treatment Based upon Our Conception of the Morbid Process.*—As there is no known specific treatment for malignant disease, we can only urge the earliest possible and most radical removal of tumors of the breast.

(2) *Treatment Based upon Certain Predominant Symptoms; Symptomatic Treatment.*—Two symptoms stand forth preëminently as of the most importance: cough—hard, harassing, persistent, due not only to the local lesions in the lung or pleura, but the result of pressure on the bronchial glands and on the nerves. For the cough it is necessary to give opiates, preferably codein or heroin, though morphin is often required. Expectorants and iodid of potash are worse than useless, as they can only cause disturbance of digestion. Pain is the second important symptom, relieved only by opiates. The pleural effusion is often so large that aspiration is necessary to relieve urgent dyspnea. Aspiration is performed only when the dyspnea is marked, as removal of the fluid tends to increase the pain to a marked degree when the diseased pleural surfaces are brought into direct contact. In certain cases the fluid reaccumulates so fast that a permanent opening, as in empyema, offers our best chance to relieve the patient.

ACTINOMYCOSIS OF THE LUNG

This disease is due to infection of the lung by actinomyces, the port of entry being probably through the bronchi. The manner of infection is often obscure, as no connection can be traced suggestive of a probable source of infection, as in two cases of the author's, one a cigar-maker and the other a bartender. No cases have been reported in the Boston City Hospital that occurred in men who worked with cattle, and only two cases are recorded.

Clinically the disease runs the course of chronic or subacute pulmonary tuberculosis, with physical signs suggestive of local abscess in the lung, circumscribed empyema, or general empyema.

Differing from tuberculosis, the process tends to spread to neighboring parts, whereby secondary sinuses may point in the back or groin.

The diagnosis is made by the finding of the small yellowish bodies of the actinomyces, the ray fungus.

Indications for and the Methods of Treatment.—As the disease is practically of a fatal nature, we cannot too strongly urge the necessity for the destruction of all animals infected with actinomycosis, the so-called "lump jaw" of cattlemen. Unfortunately, the danger of infection has not yet been sufficiently impressed upon cattle-owners.

Large doses of iodid of potash have been suggested as of avail in this disease, but statistics do not prove the value of this drug. Practically we are limited to the use of opium or one of its derivatives to relieve pain and cough, and free incision to prevent the burrowing of the pus to distant parts.

BENIGN TUMORS OF THE LUNG

As pathologic curiosities, but practically without importance from a clinical standpoint, we may mention the occurrence of fibroma, enchondroma, lipoma, and osteoma in the lung.

DISEASES OF THE BRONCHIAL TUBES

By John H. Musser, M.D.

BRONCHITIS

Inasmuch as the mucous membranes of the trachea and of the bronchi are involved in the process, the treatment of tracheitis and that of bronchitis will be considered together.

The defenses of the organism in these conditions are not usually adequate; the processes are often not severe, and the reactions not marked. We see the reactions expressed in fever, occasionally in leukocytosis, in inflammation, and in cough. The degree of the reaction is dependent in part upon the nature of the infective agent; thus a streptococcic bronchitis is usually attended by fever, the bronchitis of whooping-cough by a peculiar form of leukocytosis, and subacute and chronic forms of bronchitis by an eosinophilia. On the other hand, the defensive agency, cough, is equally dependent upon the reflex excitability of the organism, and upon the readiness with which the organism is overwhelmed by the toxemia.

To the practitioner the presence or absence of the reactions is a noteworthy guide to treatment. Thus the presence of fever at once indicates that rest and freedom from exposure are to be enjoined. Healthy adults with afebrile cases may, in fact usually do, take liberties in these respects, and are frequently those who follow their occupations and visit the physician in his office, or resort to household or quack remedies. It is true, in such cases, that the process is often limited to the larger tubes, as in tracheitis.

Cough is a defensive process which in many cases should not be suppressed; on the one hand, it would avail much if we knew how to encourage it, while in other instances its suppression or control becomes a therapeutic necessity. To attain the former, stimulants and remedies exciting reflex action or suppressing an excess of secretion must be employed with measures which lessen any toxemia; an emetic to induce violent expiratory discharge may be employed, by which the effect of cough is supplemented. To attain the latter, lessen irritation, by promoting secretion and by sedatives which obtund reflex action.

Bearing in mind these primary observations, one may proceed to the management of an attack of bronchitis, the precision and rigidity of which must be based upon the etiologic micro-organism which is the cause, upon the reaction of the patient, upon the extent of the disease, upon the age, the occupation, the hygienic and climatic surroundings, the strength and resistance of the patient, the presence of antecedent diseases of the heart or the kidneys, or of concurrent infections, as tuberculosis.

On the whole, it may be said that only those subjects in whom the infective agency is of the ordinary type (not influenza), in whom the disease is limited to the trachea and perhaps large bronchi, and who display very little reaction, as indicated by the absence of fever—only these cases may be allowed liberties. It would be better for them, lessening thereby the wear and tear of the organism and conserving their strength, if they remained indoors and at rest. All other subjects of the disease, as the very young or the aged, the feeble, those exposed to vicissitudes of temperature and of weather, to vitiated and irritating atmospheric conditions, who are the subjects of some internal disorder or associated infection, or who show a marked reaction—as fever—should be compelled to submit to strict management.

The writer must insist that this is particularly enjoined upon that class of patients who do not consider themselves ill or weak, but who are the subjects of dyspepsia, gastritis, and intestinal disorders. A neglected cold in them invites a recurrence of the gastro-intestinal disorder, chiefly through the original infection, but also because of the depressing effect of the infection on the circulation.

Acute Bronchitis.—The treatment is influenced by the extent of the disease and the intensity of the reaction. If the inflammation does not extend beyond the large bronchial tubes and is not attended by fever, the case is usually ambulatory, and such conduct is usually condoned unless the patient is feeble, aged, or has some disorder, as nephritis or chronic valvulitis. If the inflammation does extend to the smaller bronchial tubes, and is attended by excessive cough or fever, or if it occurs in those who have some previous disease, then the strict régime of an infection must be carried out.

The treatment is divided into the two forms referred to above—the mild, or ambulatory, and the more severe forms.

The mild or ambulatory form frequently presents the symptom-complex to which the term "cold" is applied, and in which the upper respiratory tract is also involved. Its treatment is that of a "cold." A discussion of the treatment must be prefaced by the remarks, which will be extended subsequently, that a "cold" or mild tracheo-bronchitis must be considered to be an infection, and, as such, treated by strict aseptic methods, none the less strict because it is only a medical case or an office patient. Such view of the case will prevent many of the disastrous local infections that follow colds, while it shortens the duration and lessens the severity of the disease. Moreover, the subject will not be a distributing agency.

Attempts are usually made to abort a cold, to jugulate a bronchitis. A purge, a sweat, a combination of purge and sweat; a sleep prolonged to a greater extent than usual, often induced by an opiate; large doses of some alkali; full doses of quinin, for the use of which in infections we are now obtaining scientific demonstration; an arterial sedative, as wine of antimony; the application of antiseptic and alkaline remedies to the nose and pharynx, are employed. Experience has often taught the patient what measures to employ.

The robust may take a hydragog cathartic, as elaterium, in a dose of $\frac{1}{6}$ or $\frac{1}{4}$ grain of the English preparation. The free catharsis, if the pill is taken in the night, may relieve the patient of the threatened symptoms by morning. A saline, if the tongue is furred and the bowels are constipated, is indicated, as magnesia or some of the anteprandial purgative waters. The usual indications for calomel or blue mass invite its use. The purgative remedies may be used in the afternoon and early evening, to be followed later by the measures to be described.

Purgation may not, however, be selected, or a laxative required. A sweat may be resorted to, preferably late in the day, to be followed by a night of rest. A Turkish bath, a hot-air or electric-cabinet bath, a mustard foot-bath followed by bed with blankets and hot-water bottles, may be employed. Such sweating process is usually increased in value by drafts of hot lemonade, by citrate of potassium in hourly doses four times, and then every two or three hours, or by a Dover's powder at bedtime. Others employ 10 to 20 grains of quinin on retiring, or a combination of quinin and Dover's powder. By some full doses (20 minims) of the tinctura ferri chloridi every two hours are looked upon as a specific. Such treatment may be followed by a moderate warm bath, followed by cooler ablutions the next morning, or, by those accustomed to it, by the customary shower or "cold tub."

The citrate of potassium has been mentioned as an alkaline remedy. It, in solution or in powder, may be given every two hours even if sweating is not induced, or other salts of potassium may be employed. The more feeble may be given ammonia and potassium salts together, or the ammonia may be employed alone. The official salts of potassium, in solid or liquid preparation, are to be used, the point of importance being to give the remedy frequently, not longer than at two-hour intervals. The chlorid or carbonate of ammonium, or the spiritus mindererus, in full doses every two or three hours, produces a good effect. The iodid of potassium or of ammonium, 5 grains every two hours, may be given. The physiologic effect is of value, particularly in those cases which may be followed by asthma, as previous attacks have indicated. There are not a few practitioners and many patients who rely upon large and frequently repeated doses of the bicarbonate of soda to abort a "cold" or cure a threatened bronchitis, 10 to 20 grains well diluted, every hour or two for twenty-four hours, being taken. For those who cannot indulge in the procedures suggested, drugs must be used, and symptomatic treatment employed. If there is rhinitis and laryngotracheitis, with headache, myalgia, feverishness, and dry cough or stuffy nostrils, a prescription like the following may be used, varying in accordance with indications derived from the state of the secretions:

℞.	Pulveris opii et ipecacuanhæ	gr. xij
	Quininæ sulphatis	gr. xij
	Acetanilidi	gr. vj
	Extracti belladonnæ	gr. ss
	Camphoræ	gr. vj

M. Caps. No. xii.
Sig.—Two at once, two in two hours, and one every three hours.

If there is weakness the acetanilid may be replaced by caffein citrate (gr. vj) or by ammonium chlorid (gr. xxiv). If the myalgia is extreme, aspirin or a salicylate preparation may replace the quinin salt (gr. xxiv to xxxvj). If there is free secretion from the nostrils and a cough in incipiency, the following may be employed:

℞. Quininæ sulphatis	gr. xij
Pulveris opii et ipecacuanhæ	gr. xij
Extracti belladonnæ	gr. ss
Camphoræ	gr. vj

M. et div. in Caps. No. xii.
Sig.—One every half-hour for four hours, then one every three hours. (Later on ammonium chlorid should replace the camphor.)

If the usual stages follow the first, the remedies suggested in the more severe forms, known as stimulating expectorants and sedatives, may be given. Then the capsules may have ingredients, as chlorid of ammonia to replace the camphor; morphin, codein, or heroin to replace the Dover's powder; and terpin hydrate or pix to replace the salicylates. The ambulatory cases may take the following when the expectoration is free:

℞. Ammonii chloridi	
Terpini hydratis	āā ʒj
Heroin	gr. ¼

Caps. No. xx.
Sig.—One every three hours. Two at night.

There are not a few instances where the cough is dry and harassing, the chest oppression extreme, and the sleeplessness most fatiguing, when resort must be taken to the relaxing expectorants. If it is wise to keep up capsules, ipecac is given or sanguinaria may be given in the powder. Often, however, it has been necessary to give a prescription like the following, and it is remarkable how promptly relief is obtained by this old-fashioned croup mixture:

℞. Syrupi sanguinariæ	
Syrupi ipecacuanhæ	
Syrupi scillæ	āā ʒj
Syrupi pruni virginianæ	q. s. ad. ℥vj

M. ʒss to ʒj every two or three hours.

Later on, ammonium chlorid may be added, and the wine of tar replace the sanguinaria, in doses of 30 to 60 minims.

Cases with Involvement of Small Tubes and with Fever.—Here I may express the conviction that a "cold" or a bronchitis must be treated as an infection, as the surgeon manages his case to prevent dissemination of the original infective agent or an imported infection; or to act as the epidemiologist to prevent reinfection or the infection of others. With this end in view, disposal of the products of inflammation, and attention to the surroundings and the family, must be considered. Rigidity of management must be guided in part by opportunity and also by the nature of the infective organism. Our experience during the past two decades shows that we cannot be too rigid in the care of cases of influenza. If, therefore, we assume to conduct a case of this character to a proper conclusion, saving time, suffering, and perhaps death, we must take procedures similar to those adopted by the surgeon when his case is prepared for operation.

The first procedure must be to make it a clean case.

1. A bath; disinfection of cavities with simple measures, as the mouth, nose, throat, and ears. Stuff the latter with cotton-wool; cleanse mucous membranes, as the eyes, with boracic solutions; cleanse and protect abraded and tender skin areas.
2. Prompt removal and destruction of all discharges.
3. A clean, well ventilated, moderately heated room with abundance of sunshine.
4. Rest in bed if fever; on a couch if no fever but other symptoms pronounced.
5. Regulation of secretions, as the bowels. Promotion of diuresis by the simple method of giving large amounts of water.
6. A light diet suitable to the general symptoms and gastro-intestinal conditions.
7. Few visitors, if any, and a minimum of exciting factors.
8. Strict cleanliness as to clothing and bed-linen and care of the room.

I am thoroughly convinced that in this manner otitis, sinusitis, bronchopneumonia, etc., can often be prevented in the infected subject and the family and friends protected from an attack of the infection. In short, a cold, a bronchitis, should be taken seriously.

Severe Cases.—The medical treatment of severe cases should be conducted on lines suggested in the forepart of this section on the treatment of mild cases.

The Infection.—The treatment should aim to aid defenses if deficient, to control them if excessive, to conserve the resistance of the organism, to manage the defensive expression of the infection,—the inflammation,—and the consequences of the infection and its defense.

The infection should be treated in accordance with the above mentioned principles. It may be controlled by modern methods of serum therapy, or by vaccination to arouse reactions, aid the formation of antibodies, and neutralize the toxins, as discussed in the first volume of this work. The *inflammation* must be allayed, aborted, or stimulated. The later results of the infection, the toxins, must be eliminated or their effects counteracted. Due attention must be paid to the secondary defenses of the organism, and hence cough may have to be aroused or checked, in accordance with its degree and effect, and bronchial secretion encouraged or repressed, while the normal eliminative processes of the organism must be stimulated.

The measures spoken of in the treatment of ambulatory cases, to which is to be added the general principle, apply here. It is to this class of cases that treatment must be directed, not alone to the pathologic processes, but to the individual, as learned by a study of the organisms and by weighing the factor of the social and previous medical history. The age, the habits, the environment, modify the treatment.

Mild diaphoretics and diuretics are given to allay the distressing general symptoms of inflammation. The so-called fever mixtures, as citrate of potassium, are grateful. Large amounts of water should be taken, hot at first to provoke diaphoresis, and later at ordinary temperature. If restless, mild sedatives may be given. Local applications to the chest, of heated flannel, mustard plasters, a hot-water bag, or a stimulating liniment, are most comforting. Extreme chest distress may be relieved by cups or by leeches, and in robust subjects the dyspnea of the early period may be relieved by venesection. Inhalations of warm vapors, or vapors to which benzoin or menthol has been added, relieve the oppression. The room might be surcharged moderately with moisture from a croup kettle or chafing dish, to the water of which carbolic acid or creosote has been added. The remedies given in ambulatory cases may be employed, although it is not necessary to use measures quite so active. The diet should be light.

Rest and attention to the inflammatory symptoms usually bring about more free secretion, particularly if relaxing expectorants or Dover's powder have been employed. The more free expectoration invites a change in the class of remedies, especially so if the fever has subsided. The stimulating expectorants previously suggested are to be employed. Preparations of ammonium replace potassium salts. Terpin hydrate and tar, alone or combined, squills, and senega are especially valuable. I use:

℞. Ammonii chloridi
Terpini hydratis.............................āā ʒj
Ft. Cap. No. xxiv.
Sig.—One every three hours.

Or pix liquida ʒj may replace the terpin hydrate. It may be too soon to relinquish the smaller doses of Dover's powder. Later it is discontinued unless the cough is out of proportion to the secretion.

Acetum or syrupus scillæ, or sanguinaria, with or without ipecac, may be used in this stage. Wine or syrup of tar is given in most of my expectorant mixtures at this time. Terebene is a very valuable remedy, 5 to 10 drops on sugar or in capsules. The oleoresin of copaiba is a similar aid. Many physicians like the syrup of garlic.

The time has come to stimulate by more general means, as with strychnin or a little alcohol, especially in the feeble or aged. Care must be taken not to begin these remedies too early, as they may increase hyperemia and aggravate the symptoms.

The Cough.—The agency by which nature removes the secretion may be deficient or excessive. While of great value, it may so disturb rest as seriously to affect the patient. It is a nice point of distinction in certain classes of cases, how far to repress cough and what remedies to employ. Too often a sedative or opiate is given when other means might allay the cough. The cough may be, and very frequently is, extra-bronchial. Attention to the nose, fauces, and larynx is often necessary, and sprays, vapors, troches, or local applications may quiet the expiratory explosions. Mucilaginous preparations, as flaxseed tea flavored nicely, glycerin, and also liquid vaselin, may be given. The following is often useful:

℞. Spiritus vini gallici .... ℥j
Glycerinæ puræ .... ℥j
Tincturæ opii comp. .... ℥j
M. Sig.—ʒj to ʒij every two or three hours.

The paregoric may be omitted and syrup of wild cherry added in the same amount; or to the formula, ammonia muriate may be added.

Changing the diet to lessen the flatulence, and the use of laxatives when indicated, are of service. Too often the cough is aggravated by a passive hyperemia from heart exhaustion, which compels the use of digitalis or other cardiac tonic. It is remarkable what relief may come from this addition to the expectorants. Strychnin may be indicated, but often it must be withdrawn because it aggravates reflex excitability and hyperemia, and hence the cough. Warm alcoholic potions at night are often helpful, as a whisky punch. The degree of cyanosis and a shallow respiratory excursion are indications not to employ sedatives. In capillary bronchitis an emetic may be necessary, as sulphate of zinc or mustard water. Inhalations of oxygen or of steam to promote secretion may be required. With engorgement of the right heart a timely venesection may give relief. To treat the cough of bronchitis with expectorants alone is to take a very narrow view of the possibilities.

The Secretion.—Secretion may have to be increased. The relaxing expectorants may suffice. The iodids are our best remedies, and in dry, unproductive cough, with sonorous and sibilant râles, the iodid of sodium or potassium, in doses of 3 to 5 grains, every three hours, soon brings relief. Inhalations of the wine of ipecacuanha was a favorite procedure of Sydney Ringer's, and we had much valuable aid from this procedure in the winter cough of our out-patients of the University Hospital when I had charge. Half hourly doses of one drop of ipecac, or minute doses of antimony frequently repeated, were also of service.

On the other hand, a bronchorrhea may exist and soon overwhelm the patient. Belladonna or atropin hypodermatically, stimulating sprays, and expectorants like terebene copaiba, are likely to give relief. Creosote by inhalations, as described in chronic bronchitis, and internally, is of service. Sandalwood oil and turpentine are very valuable.

The Toxemia.—Toxemia may be due to carbon dioxid poisoning, to the infection, or to an intercurrent inflammation, as nephritis, so often not looked for in this seemingly mild disorder.

It is important to consider fresh air, and even an outdoor treatment, as essential in bronchitis. This is all the more necessary when there is cyanosis. The value of fresh air has not been sufficiently emphasized in this paper. Outdoor treatment should be a routine practice. We cannot be too grateful to Northrup for insisting upon it. The position of the patient must be looked to, and it may be well not to keep the aged in an upright position in bed. The toxemia of the infection must be overcome by elimination and by stimulation, if indicated by enfeebled circulation or prostrated nervous system.

The complications are those referable to the heart and the kidneys. It is needless to say that when these organs are diseased or become affected secondarily a new phase enters into the treatment of the bronchitis. Mention is made of the possibilities, for too often they are overlooked.

In the treatment of special forms of bronchitis various factors must be taken into consideration. For example, capillary bronchitis is practically always the first stage of a bronchopneumonia, and should be treated as such, even if the condition does not appear to have progressed that far. Even when physical signs do not show a definite bronchopneumonia, at autopsy pathologic changes of a bronchopneumonia are practically always found.

Fetid or putrid bronchitis should be treated as a case of gangrene of the lung. General support, coupled with attempts to lessen the fetor of the breath with inhalations of antiseptic vapors, or the internal use of creosote or turpentine, are the measures employed.

Fibrinous bronchitis has yielded best to large doses of potassium iodid. Inhalations of vapors medicated with creosote or intratracheal injections of oil have proved of value in many cases.

CHRONIC BRONCHITIS

The treatment must be mainly etiologic, if possible, and the treatment of the patient rather than the disease. The general remarks on the treatment of asthma apply to this affection. The treatment must be by indirect therapeutics; the lungs must be forgotten or treated symptomatically until disorders of other organs are treated or cured. The chronic infection of the "bronchus" is an incident superimposed in most cases upon a person out of health.

Bearing in mind the remarks on the treatment of asthma, one employs agents in this affection to combat the infection, and to relieve the inflammation and its results. The infection may be improved by serum therapy and by inhalation; the inflammation allayed by the latter, by topical applications, and by change of climate. Of course, foci of infection in other parts of the body must be removed and toxic causes eradicated. To the latter, notably in this disorder, belong gout and intestinal intoxications.

Remedies must be selected that promote secretion, as in "dry catarrh," so called, or that allay excesses, as in bronchorrhea, similar to those used in acute bronchitis, and that relieve dyspnea, as noted in the treatment of asthma.

To promote secretion in chronic bronchitis, such drugs as menthol, camphor, and compound tincture of benzoin are employed, given by inhalation. Internally the iodids, ammonium chlorid, or ammonium carbonate have proved successful. Much in vogue in the past, and of undoubted value, is tar, either as the wine or in the form of tar-water, the virtues of which were vaunted by Bishop Berkeley.

With a free secretion, creosote, turpentine, terpin hydrate, naphthalin, oil of sandalwood, copaiba, and other balsams may be used. Belladonna or its alkaloid are often advantageous.

With excessive secretions, as in bronchorrhea, gallic acid internally has proved most satisfactory.

To relieve excessive dyspnea, extract of physostigmin, gr. 1/4, extract of aspidosperma, gr. ij, and strychnin are employed.

Ad. Schmidt has obtained good results in the treatment of chronic bronchitis by having the patients inhale hot dry air. The air is heated to 150° to 180° F. by passing it over a small electrical stove, arranged to give the air several heatings, and drying it out thoroughly. The patient then inhales this air for some minutes. Prolonged use has given very satisfactory results.

It is reasonable to expect that local applications would promise much, if the parts could be made accessible. The secondary bronchiectasis, it is true, may be treated by surgical means; for the diffused dilatations and chronic inflammations we may hope something from the bronchoscope.

Vaccine Treatment of Chronic Bronchitis.—Latham and others have reported cases of chronic bronchitis cured by the use of vaccines. The mouth is cleansed by the use of mild antiseptics for some hours. Cultures are then taken from the sputum and an autogenous vaccine made from the predominating organism.

Inhalation.—The inhalation treatment of chronic bronchitis has proved successful in many cases. The simplest and one of the most effective apparatus is an ordinary croup kettle. This is a small can supported by three legs, and under which is a spirit-lamp. The top of the kettle holds a funnel-shaped tube carrying off from it at an angle of about 60 degrees. The water is brought to the boiling-point and the medicine placed upon the boiling water. The vaporized drugs are then inhaled with the steam for fifteen to thirty minutes at a time, several times a day. Drugs to be employed must be readily volatilized. Such drugs as terpin hydrate, creosote, cresol, eucalyptol, compound tincture of benzoin, camphor, and menthol should be employed. The finer nebulizing sprays may also be employed, so that drugs may be used which are soluble but not necessarily volatile. Normal salt solution or any mild alkaline solution at first, and later astringents or stimulating expectorants, can be readily inhaled in this manner.

Climatic Treatment of Chronic Bronchitis.—When possible, the patient should live in a warm and rather moist equable climate, as in southern California, the West Indies, Florida, and the Mediterranean resorts in France, Italy, and northern Africa. For some patients a dry, warm climate, as found in Arizona and New Mexico, is more suitable than the more moist coast resorts. In summer a more stimulating climate will be found of great value, as in the Rocky Mountains or on the coast of Maine.

BRONCHIECTASIS

The treatment of bronchiectasis may be divided into the treatment of the general state of health and the treatment of the local lesion. The first indication is met by general hygienic measures in their fullest sense—fresh air as continuously as possible, plain but full diet, cold baths, exercises, and other measures to build up and keep the patient in the best possible physical condition.

In treating the local lesion, two indications are to be met—first, the expulsion of the sputum, and secondly, the rendering of the sputum as aseptic and inoffensive as possible. Three methods of aiding the expulsion of sputum have been used with good effect, all of them modified postural methods. Attempts have been made to continually drain the cavity—the continuous postural treatment. To accomplish this, the patient is kept in bed for a long time, the foot of the bed is elevated about 12 to 15 inches, and the patient is made to lie flat in bed with only a pillow under the head and neck, the shoulders being kept flat. The same method is also employed, but used only during sleeping hours—the intermittent postural treatment. Lastly the patient may be taught to lie across the bed with head and shoulders lower than the rest of the body, to encourage the flow of the sputum from the cavity to the bronchus, where it will irritate the healthy mucous membrane and induce hard coughing which will expel the fetid sputum.

Several methods are employed to alter the character of the discharge. Intratracheal injections have been used with good results. A simple method is to have the patient stick out the tongue and then gently inject on the lateral pharynx the drug, which then trickles down into the trachea and bronchi. The patient should be told not to swallow during the treatment, and the tongue should be kept out for some seconds after the drug has been injected. Iodoform emulsion has proved efficacious, or a dram of the following may be injected twice a day:

℞.	Menthol	ʒj
	Guaiacol	gr. xxx
	Olei olivæ	q. s. ad. f℥iij

Inhalations of creosote, oil of turpentine, or eucalyptus are also used. A tent of some light gossamer substance may be erected over the head of the bed. The medicinal agent is placed upon some water in a saucer and vaporized by heating with a spirit-lamp. If creosote is used, the eyes must be well protected by tight-fitting goggles, the nostrils and ears plugged with cotton, and the portion of the body under the tent covered with light rubber. The treatment should be brief at first until the patient becomes accustomed to the irritating vapors, when it should be increased gradually up to an hour a day. It is necessary to continue this treatment for some months, and it should always be employed after emptying the cavity by posture and cough, as should all local treatment. Internally oleum terebinthinæ rectificatum, in 15-minim doses, has proved the best disinfectant of the bronchial secretions. Terpin hydrate in large doses is also useful, as is eucalyptus. It may be necessary to give stimulating expectorants; but sedative expectorants should be absolutely avoided, as the more the cough is stopped, the greater the danger of the sputum not being expelled, increasing the decomposition from the stagnation of the contents.

Surgical interference has proved of value in only a few cases where there was a single superficial demonstrable bronchiectatic cavity in the lower lobes of the lung.

ASTHMA AND HAY-FEVER

By John H. Musser, M.D.

No formulation of the treatment of a case is possible without the sifting of all causes, predisposing and exciting. Such as are found in a given case are to be reckoned with in the management, and removed or neutralized when feasible. Frequently it is the general state of the individual that must be cared for, although often a station of excitation must be removed or subdued, an infectious area destroyed, or an intoxication, imported or autogenous, controlled.

Hence the treatment is that of the cause, of the patient, and of the disease.

ASTHMA

The predisposing causes are usually the result of hereditary predisposition, and found in families of a neurotic type often subject to other hereditary diseases, as epilepsy, gout, and migraine.

The subjects of asthma are usually of a neurotic disposition, and general stimulative treatment must be resorted to in these cases, as cold baths, exercises for breathing, outdoor occupation, and so on, and psychic treatment, as regulating the inspiratory movements by will-power.

The exciting causes of asthma are many and varied. The most frequent cause is some disturbance of the respiratory mucous membrane, as nasal polypi, chronic rhinitis, adenoids, and chronic bronchitis. In such cases treatment must be directed to the local condition, as the removal of the polyp or the adenoid growth, the cauterization of the nasal mucous membrane, and the local treatment of the chronic bronchitis.

Gastro-intestinal disturbances are also frequently the cause of asthma, as found in people suffering with a gastric neurosis, with chronic constipation, and even with intestinal parasites. The inhalation of chemicals, as in the asthma of chemical workers, of pollen, of dust, or of animal emanations, must be avoided in various cases. Attacks of asthma may be excited by psychic disturbances, by uterine and genital disturbances, by gout, by reflex irritation of the skin, of the ears, of the teeth, of practically any portion of the human body.

Essential asthma is rarely associated with diseases of the lung, of the heart, or of the kidney. However, it frequently follows some acute pulmonary trouble, a sequel causing years of distress and discomfort.

Treatment.—After eliminating exciting causes, treatment must be directed toward the attack and toward prolonging the interval between attacks. It is rare to come in contact with a virgin case. It is possible in those that begin in childhood, in the form known as "bronchial asthma," that much success may attend efforts to prevent the formation of the asthmatic habit, or to lessen the frequency of the attacks. It is all the more necessary to recognize the necessity for and to act in those who inherit a neuropathic tendency or the disease itself.

The treatment must be hygienic to develop: (*a*) a nervous system that will be stable; (*b*) a physical organism that will be resistant to or tolerant of infections, and that will possess special organs that are without, or have at least the minimum, of defect. Hence the life of the child indoors and outdoors, the sleep, the diet, the clothing, the bathing, the education—all details that make for wholesome, all-round, robust, mental and physical development, and that forbid coddling, mental, moral, and physical, are to be attended to. To form character is to help to prevent respiratory as well as moral obliquity.

If the patient has been through the mill of therapeusis, it is the custom of the writer nevertheless to proceed in a natural order of study to uncover any possible disturbing zone of morbid action. To correct astigmatism, or carious teeth, or nasal disorders, or a rachitic chest, or a weak link anywhere in the physiologic chain, is essential to a scheme of success. The general state, the blood, the muscular system, the nervous, circulatory, respiratory, gastro-intestinal, and genito-urinary systems, the various special structures and functions, all are studied. The internal secretions are not neglected and a study of metabolism should be carried on. Intoxications and infections are sought. It is remarkable how many defects may be found or perversions detected. Whatever departure there is, forces must be trained to correct it. It is true that in old cases many secondary perversions of function or structure will be found, as a weak heart, a chronic mucous-membrane inflammation, or a slight anemia. It is surprising to see how much relief can be obtained by the treatment of the results of the processes. These broad efforts lessen the frequency and mitigate the severity of the attacks, and by treating sequences, restore patients to a remarkable degree of health.

After such analyses a hygienic life is mapped out. Cold bathing is insisted upon; breathing exercises are ordered if needed, and exercises to promote general muscular development are to be urged. The breathing exercises at regular periods for a short time only, at an open window, are of much service. Diet is regulated. It is likely that the dietary that is suitable for any abnormal condition either of the gastro-intestinal tract, determined by gastric analyses, or of the organism as a whole, as indicated by metabolic studies, is the one that will be of most service. Otherwise no special diet is needed in asthma, but nutritious food, properly cooked and eaten in a rational manner, moderately partaken of at night, is all that is required. Due attention must be paid to the bowels. (See Constipation, p. 445.)

The prevention of fatigue must be enjoined. This is as important as any direction that can be given, and applies to the nervous as well as to the physical organization. Both general and local fatigue, as of the eyes, for instance, must be avoided. An abundance of attention must be given to hours of rest and long sleep must be obtained. A balance between capacity and work must be found and no excess permitted. When at rest, always let it be in the open air or in well ventilated rooms; there is no excuse not to have fresh air. Work may be conducted under similar circumstances, if possible, or in well ventilated rooms for short periods. Clothing should be light for indoors, but with removable outer garments and wraps for outdoors. Unreasonable exposure to dampness, to rain, and to fog must be avoided, experience as to their effect being the best guide. Particular attention must be paid to the skin. It is wise to have an artificial sweat with cabinet or vapor bath once a week, and to have proper frictions with the daily bath. If there is intestinal autointoxication, irrigation is of greatest service.

Asthmatics should choose their residence in a climate most suitable to themselves. Some cases are benefited by living in a warm equable climate; others do better in a cold climate. Many patients subject to asthmatic attacks do better in the heavy thick air of the city than in the clear pure air of the country.

It is difficult to direct about climate, as the personal idiosyncrasy is a factor. The rule of the writer is to permit the patient's experience to be the guide. If this is not of value, then the state of the heart, the degree and character of the bronchitis, and the tone of the general and the nervous systems must be the indications. We all know the vagaries of the asthmatic. Some of my patients live comfortably in cities, some in the country; some in low land, some in high land. The asthma season rushes some to Nova Scotia, northern New England, Canada, or the Great Lakes of this country. The winter season drives them to our great western plateau or to California. The mid-region of the southern United States, as Georgia and North Carolina, harbors many. Surely the warmer but not hot climates should relieve the aged, the laryngeal and bronchial cases. If the secretions are tough, moisture should be a climatic feature. Many are benefited by sulphur waters, and a "cure" gives relief. Again, if there is gastro-intestinal disorder of cardiac or local origin, one of the various springs may be visited for a course of waters and a general regimen, as French Lick, Bedford, or Saratoga and the Virginia Hot Springs in this country.

I am bound to say that the number who can take advantage of climatic treatment is so limited that I make every effort to make environment and patient fit in by attention to detail, with considerable success.

Medicinal Treatment.—If I had to choose between management as outlined above and medicine, I would choose the former. Medication is of great service, however, and when directed properly, is of great value. It cannot do harm when wrongly employed and the patient should not be deprived of it. Treatment must be directed to the attack and to the interval.

The Attacks.—For the acute attack nothing is so efficacious as a hypodermatic injection of morphin and atropin, giving immediate relief. Frequently an attack may be aborted by the use of a pearl of amyl nitrite, ♏iij. During severe spasms recourse must be made to chloroform, ethyl chlorid, or some rapidly acting anesthetic. Chloral hydrate, in doses of 15 to 30 gr., may also be used in those cases in which there is no cardiac lesion. When there is a cardiac lesion, chloralformamid in larger doses may be used. Drugs of the solanaceæ order are also used with varying results. The best effect is usually secured by making a cigarette of the leaves of belladonna, stramonium, or hyoscyamus, or a combination of all, steeped in potassium nitrate for inhalation. The burning of these leaves on a tray in the bedroom before retiring will frequently ward off a night attack. A strong solution of potassium nitrate soaked into paper which is subsequently dried is also a useful adjunct to the treatment, when burned and the fumes inhaled. A weak solution of cocain (2 per cent.), sprayed or inhaled into nose, throat, and trachea, is frequently useful.

Diphtheria antitoxin, given in doses of 1 : 2000 units the first day, and smaller doses in the course of a few days, has given temporary relief, and in a few cases has effected a permanent cure. This should be employed as a last resort, however, as anaphylaxis has caused the death of not a few asthmatics, who seem to possess an abnormal serum reaction.

Measures other than drugs that have been employed are stimulation with cold douches to the back of the head and neck, electric stimulation to the vagus and phrenic nerves, and deep bimanual pressure on the thorax during expiration. Recently in the few cases that have been reported almost brilliant results have been obtained by using the bronchoscope and treating the bronchial mucous membrane with local applications of cocain and adrenalin. A few cases also have been reported in which suprarenal extract given subcutaneously has produced a cure. Local applications of suprarenal extract to the nose and throat have also proved efficacious.

The use of drugs to prevent a recurrence of the attacks is more or less empiric. Four drugs are used—potassium iodid, arsenic, atropin, and nux vomica. Of these, potassium iodid, in doses of 10 to 20 grs. three times a day, used for long periods, has unquestionably given good clinical results. Arsenic, given for months at a time, suspending the treatment for about ten days each month, has given good results in young patients in whom bronchial spasm is the chief symptom. Atropin in increasing doses has given variable results.

More satisfaction has been derived by me from the use of nux vomica than from that of any other remedy. It is necessary to give large and increasing doses, as the patient soon becomes accustomed to the remedy. The plan is to order 20 drops three times daily, and to increase 5 drops every three days until 45 drops are taken. If no physiologic effect is produced, it should be increased to 60, 70, or even 100 drops. A slight vertigo, a little disturbance of vision, or some stiffness of the neck or twitching of the extremities, indicates the physiologic action. The dose should be reduced 10 or 20 drops and then continued at that dosage. After a time further increase should be made, so that the amount taken holds the patient near the point of tolerance. The aged bear nux vomica much better than the young. Many young subjects cannot take more than 20 drops. A large experience warrants the statement that results are secured by this preparation that cannot be obtained by strychnin. Patients may take it over a long period of years.

It is unfair to leave the drug treatment of asthma without insisting on the use of cod-liver oil, particularly in young subjects; of preparations of lime in the same class and in rachitics; and the use of drugs to correct the gastric and intestinal catarrh. Not to employ iron, in proper cases, is to overlook a very valuable aid in the therapeusis.

HAY-FEVER

The treatment of hay-fever was for the first time placed upon a natural and scientific basis by the researches of Dunbar. He has devised a specific serum, pollantin, which has given much success in a large percentage of cases. A drop of the liquid serum is placed in the conjunctival arch when the patient arises in the morning and a small amount of the powder is insufflated into the nose. This should be employed daily during the period of susceptibility. In addition, the patient should avoid exposure and take precautions to escape inhaling the poison. The sleeping-room should be kept closed during the day and the windows protected by cheese-cloth or gauze, being opened only at night. The patient should undress in another room and should take the daily bath at night. In addition, during the day the patient must keep out of the wind and drafts as much as possible.

By avoiding severe paroxysms and employing the specific serum regularly, some cases will be cured of the annoying discomforts of the condition. Since the work of Dunbar has shown that hay-fever is a disease caused by a specific toxin, less attention has been paid to the neurotic element of the condition, and to the treatment of local conditions, as the nasopharynx. However, in some cases psychic treatment of the disease has proved efficacious, but probably only because the patient was withdrawn from contact with the pollen toxin when other measures, as sleeping with closed windows, were added to this treatment.

Unfortunately the serum does not seem to act in all cases, even those which are due to the irritation of some forms of pollen. Moreover there are many cases with symptoms of hay-fever that are due to a mild infection in a neuropathic subject. The serum is of no advantage in such cases. Methods detailed in the treatment of asthma must be employed.

Local applications of adrenalin to the nose and throat give great relief during a paroxysm. Cocain has also proved useful, but should be avoided owing to the danger of establishing the cocain habit through the protracted use of the drug. Oily sprays of menthol and camphor, 4 grains of each to the ounce of petrolatum liquidum, are also useful. Cauterization of any point of irritation in the nasal mucous membrane has also proved valuable.

Climatic treatment should consist in sending the patient to those places where there is but little vegetation. Such places are the White Mountains or the Green Mountains, the Canadian Rockies, and the New Jersey coast resorts, of which Beach Haven and Longport are preëminently the best.

PULMONARY EMPHYSEMA

By John H. Musser, M.D.

The difficulties in treatment of this affection are well-nigh insurmountable. The fundamental lesion is one of an inherited low vitality of the tissues with a degenerative tendency. The organism has little opportunity for defensive reaction. The therapeutist has to meet conditions after they have been under way a considerable time. Finally the alleged predisposing causes are difficult to control or minimize, partly because they are occupational and of necessity must be continued. A cure, therefore, is not to be expected and adaptation must be secured.

The patient finds he has a respiratory apparatus that is insufficient. He cannot indulge in physical exercise requiring an extra respiratory effort. He must increase resistance so that the liability to infections is lessened. He must see to it that cardiac exhaustion does not arise. Instinctively, automatically the defenses of the organism are put up, and hence we see the peculiar attitude, the characteristic walk, the physical changes in the thorax and the hypertrophy of the extrinsic respiratory muscles.

The therapeutist can aid nature if he has control of some or all of the predisposing causes, as those of environment, of general and personal hygiene, of occupation, diet, etc., and if he can so develop resistance as to lessen the disasters of infections. The general principles, which we attempted to lay down for adoption in the management of asthma, herein apply and are to be followed in the management of emphysema.

Just as in asthma we attempt to control predisposing and exciting causes, so do we proceed in the management of emphysema.

The predisposing causes are: Hereditary predisposition; old age, on account of the rigidity of the costal cartilages, and subsequent loss of the elasticity of the thorax; occupation, as in glass-blowers, musicians using wind instruments, and workers inhaling continuously various kinds of dust; diseases, preëminently asthma and chronic bronchitis, to a lesser extent cardiac diseases, whooping-cough, pleurisy with adhesions of the two layers of the pleura, and diseases of the respiratory passages other than bronchitis and asthma; and chronic alcoholism. The exciting causes are anything causing increased intra-alveolar pressure, as cough or muscular effort with the thorax distended while blowing or straining.

Notwithstanding the reasonable doubt raised by Edsall as to the influence of some of these factors, *i. e.*, the influence of occupation, upon emphysema, we are bound as yet to attempt to control or remove even those which have the sanction of tradition alone, inasmuch as every opportunity, chance or otherwise, must be employed for the welfare of the patient in this terrible disorder.

In the treatment of this disease we invoke aid from physiologic therapeutics and indirect therapeutics. By the former we aim to aid nature in adaptations of exercises which develop the respiratory muscles and which regulate respiratory rhythm. We aim to stimulate that respiratory neurosis which is the essential cause of asthma, and hence we increase respiratory morale by breathing exercises and the best hygiene possible. For a similar physiologic purpose we use the pneumatic cabinet and have the patient breathe into rarefied air.

Various forms of aërotherapeutics have been employed to relieve the dyspnea and to increase the capacity of the lungs. The inhalation of air compressed at a pressure of one-half to one atmosphere in the pneumatic cabinet or chamber, when used frequently for an hour a day over a period of months, has given permanent relief in many cases. Fraenkel's apparatus for inhaling compressed air has proved useful, as has Waldenburg's, which also permits expirations into rarefied air. Expirations into rarefied air, however, are of doubtful value, as it has been shown that but little more air is expired into rarefied air than under normal conditions.

Inhalations of oxygen have been recommended in many cases. Compression of the chest, as recommended by Gerhardt, mechanically compressing the chest of the patients during expiration, has proved of great benefit in young children with non-rigid chest-walls, who are the victims of acute emphysema following whooping-cough, croup, or laryngeal obstruction.

An attempt has been made by Freund to aid adaptation by operative measures through mobilization of the "primary costal rigidity and the dilated thorax" by removing small portions of the costal cartilages.

By indirect therapeutics we add to the comfort of the patient, stay the progress of the disease by the removal of intrinsic causal factors, and prevent or minimize the effects of the congestions and inflammations which are sure to follow in the train of the degenerative processes.

Drugs have but little effect upon the local condition, but employed as tonics to build up the general health in order to prevent bronchitis, give favorable results. Cod-liver oil, given throughout an entire winter, iron, and potassium iodid are the drugs used with best result. Mild counter-irritation in some cases is a useful measure when employed for a long time.

To relieve the frequent attacks of bronchitis, the measures employed in an ordinary attack of bronchitis should be used, while the spasmodic dyspnea may be treated with the measures employed to relieve bronchial asthma. Extreme dyspnea, cyanosis, and engorgement of the right heart should be relieved by immediate venesection. When not severe enough to require venesection, digitalis in large doses gives great relief.

The data derived from a study of other systems and organs give important indications for treatment if functional or organic disorder is found. This particularly obtains in disorders of the circulatory and gastro-intestinal tracts and in disturbances of metabolism. We must take advantage of the first indications of failing circulation by employing measures to prevent cardiac exhaustion and stay the secondary pulmonic results thereby. We must prevent abdominal plethora and flatulent distention of the stomach and intestines. We must prevent all forms of auto-intoxication. Lastly, alcoholism must be cured and the taking of alcohol must be discontinued. By treatment thus directed and by attention to elimination, life can be prolonged and made endurable.

The choice of climate in emphysema must rest upon the variety of the bronchitis and upon the state of the heart and vessels.

HEMOPTYSIS

By James E. Talley, M.D.

By hemoptysis is meant the spitting of blood which arises from the bronchial or pulmonary vessels. The hemorrhage may arise from external injury or be due to some morbid condition existing within the individual. Hemoptysis arising from external injury belongs to the domain of surgery, and will not be discussed. A full list of pathologic conditions causing hemoptysis is given by Babcock,[1] to whom, as well as to Bonney,[2] both writers on hemoptysis in all its phases, the writer expresses his indebtedness. These possible conditions are: pulmonary tuberculosis, bronchitis, bronchiectasis, acute pneumonia, pulmonary cirrhosis, pulmonary abscess and gangrene, cancer of the lung, pulmonary syphilis, chronic heart disease,—including pulmonary infarcts and pulmonary apoplexy,—aortic aneurism, arthritis diathesis, blood diseases (scurvy, purpura hemorrhagica, pernicious anemia), acute infections (typhoid fever, influenza), distomum pulmonalis, vicarious menstruation, nervous influences (injury of central nervous system, insanity, epilepsy, hysteria, adolescence).

Of all morbid conditions causing hemoptysis, pulmonary tuberculosis is by far the commonest. It may occur at any stage of the disease, but more often early, and is often the first symptom that attracts the attention of the individual or the physician. It occurs in from 60 to 80 per cent. of all cases of pulmonary tuberculosis[3] at some time in the course of the disease. The origin of the bleeding may be either in a bronchial or in a pulmonary vessel. In early hemoptysis the most likely cause is the development of a tubercle in the wall of a small vessel or capillary. In later stages the same destructive process affects vessels as well as lung tissue. Initial hemoptysis is usually small and may vary from streaking of the sputum to a few ounces, and very seldom a pint. As a rule, these early attacks tend to recur. Though the repeated loss of small amounts of blood means considerable in the aggregate, such losses rarely cause death. In late phthisis the hemorrhage may arise from a large vessel and be sufficiently profuse to be lethal. Occasionally profuse hemorrhages, one or two pints, occur at long intervals, and do so without apparent lasting harm. The dangers from large hemorrhages are exsanguination and collapse. The dangers from both large and moderate hemorrhages are possible asphyxia, and, later, atelectasis and bronchopneumonia. More than a mere streaking of the sputum in bronchitis should be cause for a careful examination of the chest for a possible underlying tuberculosis. Such an examination is more often satisfactory only after amelioration of the signs of bronchitis. In bronchiectasis and pulmonary cirrhosis hemoptysis is comparatively frequent. In acute pneumonia, though hemorrhage is exceedingly rare, it occasionally occurs at the onset and sometimes later. The only cases the writer has seen have been in alcoholics. In the worst case the amounts were from ½ to 1 ounce, the bleeding occurred at frequent intervals and persisted for days, but the patient recovered. No underlying tuberculosis was found. In cancer of the lung hemorrhage is about as common as in tuberculosis. In chronic heart disease, especially mitral stenosis, slight hemorrhage is frequently due to passive congestion. The origin is probably the congested bronchial mucous membrane. Large hemorrhages would suggest pulmonary infarct.

TREATMENT

The same general principles underlie the treatment of hemoptysis whatever the cause. Pulmonary tuberculosis so far exceeds all other etiologic factors that the discussion of the subject naturally centers around that complaint. Although it is a satisfaction in hemoptysis to know the exact extent of the consolidation and cavity formation, it is decidedly unwise to make use of any methods save inspection and auscultation to determine these points until the hemorrhage is over and all danger of recurrence seems well past. Mere morbid anatomic changes alter little, if any, the therapeutic procedures, and clinical symptoms alone are a sufficient guide. There are many details of treatment, each small in itself, but in the aggregate of vast importance to the welfare of the patient. In the first place, every case of hemoptysis should be looked upon as a serious condition. The possible severity of the hemorrhage may not be in direct proportion to the extent of the pulmonary involvement nor to the time of its existence. Though preceding hemorrhages have been slight and far between, this fact gives no assurance for the future. To allow any patient with hemoptysis to follow his usual physical activities is negligent. The only exception to this statement is in those persistent cases of mild hemoptysis where, in spite of prolonged rest, the condition persists. A few observers have allowed such cases to get up and perform carefully graded exercises, with, they claim, good results. Every case of hemoptysis should be put to bed. Where the hemoptysis is slight, the semi-recumbent position is sufficient. It favors expectoration, lessens disposition to dyspnea, and allows gravitation of the blood to the lower part of the body. Where the hemorrhage is severe, the patient is better flat on his back, because he can maintain this position longest with least fatigue. Any movement, even to expectorate or take food, may prove sufficient to provoke renewed hemorrhage. The blood and sputum may be received into pieces of cheese-cloth, which should be burned, as the sputum may contain both tubercle bacilli and pneumococci. The food and drink should be given by means of tube or feeding-cup. The best results are obtained by isolation of the patient with a nurse or attendant who is deft of hand, light of foot, and optimistic of temperament. Thus is the patient spared many annoyances which increase the already existing nervousness and apprehension. That this is important finds easy proof in the well recognized influence of emotion over blood-pressure even in health. The physician should seek to allay this apprehension of the patient. Death during or immediately following a hemoptysis is unusual. Of the 386 cases of early attacks of hemoptysis reported by Ware,[4] only three succumbed during the early attacks. Of course, rupture of an aneurism, erosion of a large vessel, bleeding into a large cavity, and the supervention of pneumonia may all cause death more or less frequently, but fortunately they are the rarer accidents. Conversation should be forbidden, for enunciation means expiratory effort, and in turn increased intrapulmonary pressure. Even the arms and legs should be kept quiet, for all muscular movement increases blood-pressure. The room should be cool, 50° to 60° F., but free from drafts, and so situated as to be farthest removed from the noises of the household. Ice may be given, as it keeps the mouth moist and clean, allays cough, and prevents nausea. In excess it may disarrange the stomach. Lemonade should be avoided, as it may increase the coagulating time of the blood. The diet should be preferably cold; it may be warm, but never hot. It should be liquid or semi-liquid to avoid the effort of chewing. It is better to give no food until several hours after the hemoptysis ceases. Forty ounces of milk and four to six raw eggs are sufficient during the first twenty-four hours. In severe attacks liquids should be much restricted and the diet scant for several days. During the second and third days small quantities of food given at frequent intervals may be selected from such articles as milk, raw eggs, beef juice, gelatin, junket, ice-cream, scraped beef. The return to the ordinary dietary should be slow, especially in large hemorrhages, as a too sudden filling of the vessels may result in reopening of the bleeding point. The combination of morphin and enforced rest in hemoptysis so naturally leads to constipation that great care must be taken to prevent straining at stool. Neglect of this precaution may lead to renewed hemorrhage. A daily evacuation of the bowels should be secured by laxatives, and if these fail, by enemas of soap and water, or olive or cotton-seed oil, 2 to 4 ounces, or, where necessary, by the compound enema containing glycerin, epsom salts, turpentine, and soapsuds, or normal salt solution. Though the bowels open by such measures, it is advisable to give a saline cathartic every few days in order to avoid any accumulation higher up in the colon.

The intelligent treatment of hemoptysis necessitates the clear recognition of the fact that in this condition, at present, surgical procedures afford no help, and the physician must rely alone upon aiding those natural tendencies of the organism which make for a spontaneous arrest of the hemorrhage. These methods of nature are: (1) Lessening of blood-pressure and decrease in rate of flow; (2) increase in coagulation and thrombus formation; (3) lessening of volume of blood; (4) contraction of vessels.

The nitrites are the most useful drugs for lowering blood-pressure. Amyl nitrite was originally suggested by Francis Hare, and more recently advocated by Ghelfi,[5] Crace-Calvert,[6] Placak,[7] and others, for its rapidity and efficiency in many cases of hemoptysis. They found that 5 or 6 drops inhaled from cotton or a handkerchief produced an immediate fall of blood-pressure. In rabbits Soulier and Petitjean[8] observed intense anemia of the parenchyma without any reactionary hyperemia such as follows the use of adrenalin. The cessation of hemoptysis was often sudden and permanent. Pearls of 3 to 5 minims may be given patients prone to hemoptysis to try at once in case of need. Flick[9] has used nitroglycerin, ½ to 1 drop, even as often as one-half to an hour, using as his guide the accentuation of the second pulmonic sound. Since the blood-pressure apparatus has come into common use, a better guide would be the determination of systolic pressure every two hours, and the administration of sufficient nitrite to maintain an even, moderate pressure. If the patient is excited and apprehensive, an occasional dose of morphin or codein may be given with the nitrite to prevent the fluctuations of pressure which are worse than a steady high pressure. Sodium nitrite is probably more persistent in its action than nitroglycerin. One or two grains by mouth or hypodermatically may maintain its action as long as three hours.

Gaultier[10] recommends in hemoptysis where there is hypertension aqueous extract of mistletoe (*Viscum album*), which appears to be a vasomotor dilator. The dose is ¾ gr., repeated every two hours. Gaultier has given 4½ gr. during a day with uniformly good results.

Atropin sulphate is a valuable drug in the treatment of hemoptysis, recommended for this purpose, at least as early as 1868, by Lebert,[11] of Breslau. It was slow in gaining the foothold it deserved, one reason for which may be that atropin sulphate is a marked vasomotor stimulant, and practitioners overlooked the fact that the dosage recommended was large enough to be mildly toxic. The effect of such doses upon the circulation is quite different from that of the ordinary dosage. Atropin sulphate is especially useful in large hemorrhages, and the dose should be $\frac{1}{50}$ gr. or even $\frac{1}{25}$ gr., hypodermatically. The first evidence of its action is a general hyperemia of the skin, which shows that the primary vasomotor stimulation with increased blood-pressure has given way at once to a general capillary paresis with consequent fall of blood-pressure. Since it is assumed, though as yet not proved, that the intrapulmonary pressure varies directly with the systemic pressure, the rationale of the use of a large dose of atropin and other vaso-dilators finds at least a working explanation. It is to be expected that such large doses of atropin will produce mydriasis and dryness of the mouth, but these discomforts are nothing when compared with the usual favorable action of the drug on the hemorrhage. Though they are in many respects physiologically antagonistic, yet practical experience shows that morphin and atropin may be given together with advantage in such conditions. On account of the discomfort, it is usually better not to repeat the dose of atropin during any one hemorrhage, but, if necessary, to make use of other drugs and means advised. Aconite has been used by some to maintain low blood-pressure in hemoptysis. Since we have safer drugs for the same purpose, the use of such an active and often uncontrollable depressant, in a patient already weakened by disease and loss of blood, is to be condemned. Apomorphin, ipecacuanha, tartar emetic, and other nauseants have also been recommended, but it would seem wise to exhaust the list of other remedies before resorting to drugs with such unpleasant effects.

Morphin is one of the most important drugs used in hemoptysis. It allays cough, secures calm, retards the respiration and the pulse, and this reduced flow of blood in the lungs allows time for spontaneous coagulation and repair of the bleeding vessel where possible. It should always be given hypodermatically, as it acts more promptly and seems less apt to produce nausea. The dose should be adapted to the individual. Usually $\frac{1}{8}$ to $\frac{1}{4}$ gr. is sufficient for the individual dose, but care must be used in children and in the aged. Where the hemorrhage is severe and tends to recur at short intervals, it may be necessary to continue the use of the morphin even three or four days. Even here the desired effects can usually be obtained without reducing the respirations as low as twelve or less to the minute, as advised by some writers. It is necessary only to mention the necessity for regular relief of the bladder and bowels during this prolonged use. Physicians must always be alive to the fact that too prolonged narcosis, with too prolonged rest in one position, may serve to retain blood in the lung and lead to aspiration, atelectasis, and pneumonia. The writer believes that codein sulphate, $\frac{1}{8}$ to $\frac{1}{2}$ gr. hypodermatically, is quite as efficient and less apt to nauseate than morphin. Heroin hydrochlorid, $\frac{1}{20}$ to $\frac{1}{10}$ gr., and dionin, $\frac{1}{4}$ gr., are to be borne in mind as alternatives.

Lawrason Brown[12] has called attention to the frequency of early morning hemoptysis and the explanation of this afforded by Howell's theory of sleep. The theory is that sleep is due to fatigue of the vaso-constrictor centers, and the plethysmograph shows that a dilatation of the peripheral vessels occurs during sleep. The marked variations in the plethysmograph records in the early morning hours when the vaso-constrictor centers are regaining their tone, indicate that varying quantities of blood are supplied to the right heart, with concomitant variations in the intrapulmonary pressure. As already stated, fluctuations in pressure are worse than a steady high pressure. To avoid these fluctuations as much as possible and to equalize the pressure, Brown advises to give to such patients morphin and sodium nitrite hypodermatically between midnight and 2 A. M., waking the patient if necessary.

Among drugs used to check hemorrhage by producing increased coagulability of the blood are calcium chlorid, or, better, because less irritant to the stomach, calcium lactate, 10 to 30 gr. The latter may be given in capsule. The former is very deliquescent and must be given in solution. They are slow of action, lose their effect after twenty-four to seventy-two hours, and on the whole, though when experimentally injected intravenously they may increase coagulation, it is doubtful whether enough is ever absorbed through the gastro-intestinal mucous membrane to produce this effect. However, the lactate is worthy of trial.

The experiments of H. C. Wood, Jr.,[13] seem to prove that gelatin, even when taken by the mouth, digested, and absorbed, has definite influence in increasing the coagulability of the blood. Its exact mode of action is not fully understood, but Wood calls attention to the fact that other albuminoid bodies likewise hasten coagulation. The administration by mouth has the disadvantage of being slow, but has the advantage of avoiding any danger of infection, especially tetanus. Wood recommends by mouth a dosage representing 2 to 4 drams of dry gelatin, three or four times a day. It may be given in a 10 per cent. jelly flavored to taste. The ordinary gelatin used in the household contains only 3 to 4 per cent. of gelatin itself. Where the conditions are urgent, gelatin may be given subcutaneously. Two to six ounces of a 2 to 5 per cent. solution in warm normal salt solution is given according to the ordinary method of hypodermoclysis. Wood urges the great care necessary in preparing these solutions, as pyogenic infections and fatal tetanus have resulted not infrequently from the hypodermatic use of gelatin. Even repeated boiling, though it destroys the bacillus, may leave the toxins active, and the patient may die of tetanus though no bacteria are introduced. There are certain sterilized solutions of gelatin on the market for hypodermatic use which have been tested upon guinea-pigs. Even these solutions should be boiled for twenty minutes just before use. The repeated boiling does not affect the coagulating action of the gelatin on the blood. Where these tested solutions cannot be obtained, the gelatin for hypodermatic use may be prepared according to the recommendation of Bonney:[14] "Sterilized salt solution, 4 oz., white gelatin, ½ oz., make slightly alkaline with sodium hydroxid, ½ dram. Place in flask with glass stopper and sterilize one-half hour under steam for five successive days. If cloudy from alkalinization, it should be filtered until clear. This is to be diluted eight times to make one quart for subcutaneous use." The only objection to this method is the long time necessary for the preparation of the solution. Though the use of gelatin by rectum has been recommended, the administration by mouth or hypodermatically, though painful, has great advantage in point of time of absorption.

The wide-spread practice among the laity of giving large doses of common salt in hemoptysis is usually considered useless. However, von der Velden[15] claims that 3 to 5 c.c. of 10 per cent. sodium chlorid solution given intravenously during hemoptysis, in two to four minutes produces a marked measurable increase in the coagulating power of the blood. He finds that the same result may be obtained in eight to twelve minutes by giving 5 grams of sodium chlorid or 2 to 4 grams of sodium bromid or potassium bromid by mouth. This simple therapy, which probably depends upon a production of thrombokinase from the tissues, has given good results in his hands.

In this connection the case of hemoptysis treated by Dewar[16] with intravenous injections of normal serum is important. The patient, with apparently healed pulmonary tuberculosis, was suddenly seized with hemoptysis, which continued for sixteen days, in spite of almost every known treatment, including normal serum by mouth. Dewar finally gave him 20 c.c. of normal serum intravenously, and the hemoptysis ceased at once. The troublesome urticaria and arthritis which followed possibly might have been avoided had the operator, in his anxiety for a permanent result, not repeated the 20 c.c. of normal serum on six successive days.

Kraemer[17] finds that tuberculin is not contraindicated during or after hemoptysis. He believes it is good, both as a prophylactic and as a curative agent, especially in recurring hemorrhage. It is supposed to act by promoting the healing of the tuberculous focus.

Cotarnin hydrochlorate, ½ to 3 gr. hypodermatically, has some reputation in averting pulmonary hemorrhage. Wood states that it is undecided just how it acts. It may be by some sort of astringent action or by affecting the blood. The drug probably has no direct influence on the circulation.

All astringents, as tannic acid, gallic acid, alum, and preparations of iron, are not only useless, but derange the stomach. Senator[18] condemns the above, and also hydrastis, hamamelis, stypticin, styptol, and turpentine. Lead acetate he thinks increases the viscidity and coagulating power of the blood, and he occasionally uses it.

Bonney's[19] observations on venesection are most satisfactory. Ordinarily, any attempt to reduce arterial pressure in the pulmonary circulation by venesection is irrational, as the hemorrhage itself has probably already produced any good to be derived in this manner. He has found that moderate venesection does good where the initial hemorrhage has been slight, and recurs where fever has been persistent and blood-pressure high. Venesection may do good in pulmonary tuberculosis accompanied by nephritis, where the abnormal high blood-pressure seems to provoke and prolong the hemoptysis. Again, in bronchopneumonia following hemoptysis, when the right heart is overworked or dilated, blood-pressure high, and pulmonary edema, cyanosis, and coma imminent or present, venesection may do good, at least temporarily. In this connection arises the question of the use of normal salt solution by rectum, subcutaneously, or intravenously. After venesection in bronchopneumonia it should be used subcutaneously. In the collapse following very large pulmonary hemorrhage salt solution by hypodermoclysis may save life. The fear that renewed volume in the vessels and consequent increase of intrapulmonary pressure may cause recurrence of hemoptysis in such cases proves groundless clinically, where the procedure is used judiciously. The patient being in collapse, the salt solution, bringing the volume of circulation to normal, stimulates the heart to renewed contraction and, unless used in excess, does not seem to decrease the tendency to thrombus formation.

Possibly the idea in the early and wide use of vaso-constrictors in hemoptysis was that vasomotor stimulation lessened the caliber of the pulmonary vessels, and this action on the proximal side of the bleeding vessel served to check the hemorrhage. In the first place, the pulmonary vessels possess a very weak vasomotor apparatus; some physiologists deny its existence entirely, and any drug capable of producing such marked rise in systemic pressure as ergot and adrenalin might naturally be expected to have an effect contrary to that desired upon the pulmonary circulation.

On account of its marked influence in checking uterine hemorrhage ergot was largely used for hemoptysis in the past. Theoretically it is bad, and practically it is useless in pulmonary hemorrhage.

Theoretically, adrenalin is undesirable in hemoptysis. Wiggers,[20] experimenting with therapeutic doses of adrenalin in pulmonary hemorrhage, found that though the drug did not raise the pulmonary pressure, yet the volume of blood contained in the pulmonary vessels was much increased. This was not due to the "back effect" of the rise in the aortic system, nor to vasomotor constriction of the pulmonary vessels, but to the fact that a greater amount of blood is thrown into the distensible pulmonary vessels by the increased activity of the right ventricle in a given time than is passed on to the left ventricle. He concludes that adrenalin is not a fit drug to use during pulmonary hemorrhage to raise the general blood-pressure. Meltzer[21] has dwelt upon the frequency with which the use of suprarenal gland preparations in experimental work causes pulmonary edema, and Babcock calls attention to the fact that the hypodermatic use of adrenalin has been followed by sudden death. Practically, Hilbert[22] and Coleman[23] have found adrenalin chlorid (1 : 1000), 5 drops, or suprarenal extract, 3 gr., every three or four hours, useful in hemoptysis. They have had no untoward results. Unlike ergot, there is a possibility that it may influence hemorrhage by other than vasomotor means, and when other methods fail, especially in small oozing hemoptyses, adrenalin should be carefully tried.

The use of digitalis in active pulmonary hemorrhage, or where recurrence is feared, is bad because of its influence in increasing blood-pressure. Where the hemoptysis is due to the passive congestion of cardiac disease, and occasionally in the hemoptysis of pulmonary tuberculosis where the hemorrhage has ceased for some time, and a feeble heart with lowered pressure leads to the fear of renewed hemoptysis on this account, the judicious use of digitalis, the effects being carefully noted, is permissible. The use determined on, it is best to assure an active preparation by procuring a fresh infusion of leaves or some of the standardized preparations.

Special Methods.—The principle involved in the use of cold in the treatment of hemoptysis, according to Babcock, is a reflex stimulation of the vaso-constrictor fibers of the upper five dorsal nerves of the sympathetic system. In the light of what has already been said concerning the vasomotor system of the pulmonary vessels, the exact action of the cold appears still an open question. Where there is much arterial excitement the application of cold to the cardiac area, as by an ice-bag, is of unquestioned benefit. In slight hemoptysis the applications to the chest of cold compresses, the site being changed at intervals of half a minute, as advised by Babcock, should be tried. Where the site of involvement is reasonably sure, cold may be applied for a longer period by means of the lead coil, the rubber coil, or, better, because more easily applied, by the ice-bag. The placing of flannel or gauze beneath the ice-bag adds to the patient's comfort and protects the skin. Too prolonged use of the cold is to be avoided. The application of cold to the genitalia has been recommended for its reflex action.

Kinnear[24] advises the application of a hot-water bag at 115° F. over the dorsal vertebræ, and claims that this procedure strongly contracts the arterioles of the small bronchi and lung. Heat in excess of 120° F. may be dangerous to weak hearts. Faradization of the chest-wall has been advised, the action being the same as that of cold. Constriction of the extremities near the trunk where the hemorrhage is severe is a useful procedure. The band is to be applied so as to retard the venous but not the arterial circulation, the object being to delay the flow of venous blood to the right heart. This constriction may be kept up from an hour to a day. The removal of the bands should be gradual, not more than one being removed at half-hour intervals. Rapid removal of the ligatures may provoke renewed hemorrhage. Limiting the respiratory movement of the chest, especially of the affected side, and thus reducing the blood-flow through the lung containing the bleeding vessel, is frequently advocated. This immobility is secured in various ways. Strapping the affected side by means of overlapping adhesive straps from sternum to spine has long been used. Since it is often difficult to determine during hemorrhage the origin of the bleeding, Bonney advocates limiting the entire respiratory movement on both sides, by applying a broad adhesive band around the entire chest just below the nipples. The results appear to be just as good, and the application is made with less disturbance of the patient. In this connection it is interesting to note that Caley, as early as 1853, tried to check hemorrhage by producing an artificial pneumothorax. Murphy has sought to produce compression of the lung by injecting sterile nitrogen gas into the pleural cavity.

Many attacks of hemoptysis cease spontaneously. This is more apt to occur if the physician directs his patient according to the general principles of treatment in the beginning of this article. Where drugs become necessary I have found that nitroglycerin, morphin, and atropin rarely fail. However, the exceptional persistent attack has made it seem advisable to consider in detail all methods and drugs that have been found useful.

References

1. Babcock: "Diseases of the Lungs."
2. Bonney: "Pulmonary Tuberculosis."
3. Babcock: Ibid., p. 160.
4. Hare: Osler's "Mod. Med.," III, 731.
5. Ghelfi: Gazz. d. Ospedali, 1907, 153.
6. Crace-Calvert: Münchener med. Wochenschr., 1908, i, 885; Br. J. of Tub., 1908, ii, 189.
7. Placak: Cleveland Med. Jour., July, 1908.
8. Soulier and Petitjean: Gazz. d. Ospedali, 1907, 153.
9. Flick: Jour. Amer. Med. Assoc., 1908, li, 129.
10. Gaultier: Medical Record, 1908, lxxiv, 642.
11. Soble: Medical Record, 1892, xii, 11.
12. Lawrason Brown: Osler's "Mod. Med.," vol. III, p. 404.
13. Wood: "Therapeutics," 14th ed., p. 399.
14. Bonney: Ibid., p. 720.
15. V. d. Velden: Münch. med. Wochenschr., 1908, lv, 2254; D. Naturfor. u. Aerzte, Versamm., 1908.
16. Dewar: Brit. Med. Jour., No. 2554, Dec. 11, 1909, p. 1664.
17. Kraemer: Wien. med. Woch., 1908, 2140 .
18. Senator: Ther. d. Gegenwart., 1908, x, 481.
19. Bonney: Ibid., p. 720.
20. Wiggers: Arch. Int. Med., vol. iii, No. 4, May, 1909; Am. Jr. Physiology, 1908, xxiii, 25.
21. Meltzer: Trans. Assoc. Am. Phys., vol. xxi, 1906, 171, 173.
22. Hilbert: Deut. med. Woch., 1907, 2076.
23. Coleman: "Tuberculosis," Klebs, 633.
24. Kinnear: Brooklyn Med. Jour., October, 1907.

PULMONARY EDEMA

By James E. Talley, M.D.

Pulmonary edema is a condition in which the blood-serum leaks through the capillary walls into the air-vesicles and intervesicular tissues. This edema may be local or general. Local or collateral pulmonary edema occurs around circumscribed lesions of the lung, as inflammatory areas, pneumonia, new-growths, abscess, localized empyema, infarcts, and tuberculosis. In origin it may be congestive or toxic and inflammatory. General pulmonary edema may be chronic or acute. The chronic form occurs in chronic heart disease, chronic nephritis, chronic pulmonary congestion, anemia, cerebral disease, chronic infections, cachexia, and, as a terminal edema, in slow death, it occurs according to Coplin in 20 per cent. of chronic cases. The form of general pulmonary edema under discussion is allied with subcutaneous edema. It may also be more or less acute. Riesman[1] has written fully upon a form of acute pulmonary edema which is distinguished from the above by the severity of its onset without apparent cause, by the suddenness with which it may cause death, and by its tendency to recur if the patient survives; also to some extent by the morbid conditions with which it is allied, and the fact that in typical cases it is never associated with subcutaneous edema or effusion into serous cavities. The conditions in which this form of acute pulmonary edema occurs as given by Riesman are: arteriosclerosis, Bright's disease, heart disease (angina pectoris, myocarditis, valvular affections), asthma, acute infectious diseases (typhoid fever, measles, rheumatic fever, influenza, pneumonia, scarlet fever), pregnancy, paracentesis of thorax and abdomen, angioneurotic edema, and obscure conditions of questionable causal relationship (hysteria, tabes dorsalis, ether anesthesia). Cerebral conditions, as apoplexy and epilepsy, may be added.

Welch was the first to attempt to explain pulmonary edema experimentally. His theory deduced from his investigations is known as the "cardiac" or "mechanical" theory. He states it tersely thus: "Pulmonary edema is the result of a disproportion between the working power of the left ventricle and the right ventricle, of such a character that, the resistance remaining the same, the left heart is unable to expel, in a unit of time, the same quantity of blood as the right heart." The marked rise of pressure in the pulmonary artery in his experiments made him consider this an important factor in the explanation. The fact that in some cases of acute pulmonary edema the pulse may be normal, or even of high tension, has been used as an argument against Welch's theory. The application of the cardiac theory to the explanation of the acute pulmonary edema produced by the injection of adrenalin, first suggested by Meltzer, and confirmed by the experimental work of Miller and Matthews,[2] has an important bearing on the subject and establishes an important clinical fact. In the words of the two experimenters: "It is well understood that high systolic pressure may be associated with small systolic output, provided the pulse-pressure, *i. e.*, the difference between the systolic pressure and diastolic pressure, is reduced. A high-tension pulse does not necessarily imply normal systolic output." They find that in nephritis with high blood-pressure the conditions are similar to those produced in adrenalin injection, and thus Welch's theory is adequate to explain the acute pulmonary edema occurring in some cases of Bright's disease. Of course, this need not imply that toxic substances circulating in the blood may not be an added factor. More recently there has been made an effort to explain pulmonary edema on a chemical basis, and various investigators have shown that the problem is probably too complex to be explained by the mechanical theory alone in all instances. Acute pulmonary edema has been produced experimentally by muscarin, Lugol's solution, acetic ether, adrenalin, and artificial mitral stenosis, and though disproportion in the working power of the two ventricles has developed, the experimenters have not always been convinced that this is the only causal factor.

Miller and Matthews, experimenting with acetic ether, found that though usually when inhaled or given intravenously evidence of disproportion in the working power of the two ventricles arose, still when large doses were given intravenously, pulmonary edema occurred without any evidence of this disproportion, thus showing that such changes are not necessary for its appearance. The same investigators, working with nitrous oxid and ammonia vapor, were able to produce a pulmonary edema without the usual cardiovascular changes found in the experiments of Welch and his followers; that is, a constant fall of systolic pressure, a rise of pressure in the pulmonary artery, and dilatation of the right heart with the left heart remaining normal in size. They take it that irritation of the bronchial mucous membrane and alveolar epithelium or of the underlying vessels was an important factor. Von Zeissl, though his experiments with Lugol's solution tended to confirm the mechanical theory, also suggested that changes in the vessel-walls might be a factor in the development of pulmonary edema. Sahli, using dogs, was able only infrequently to produce pulmonary edema, and concluded that the more regular occurrence of the acute pulmonary edema, in experiments upon rabbits, was due to the greater permeability of their vessel-walls. Thus is supplied experimental evidence in favor of Martin's theory of increased permeability of the vessel-walls as a possible factor in the development of acute pulmonary edema. This change in the vessel-walls, due to pressure, plus Riesman's "congestion by recoil," would best explain the acute pulmonary edema following paracentesis of the thorax. The toxic vasomotor theory presupposes that acute pulmonary edema is due to the action of toxic substances on the pulmonary vasomotor apparatus. The objection to this theory as sufficient alone, is the fact that even those physiologists who grant the existence of pulmonary vasomotor nerves agree that their action is slight. Riesman suggests that this theory might explain acute pulmonary edema in some cases of Bright's disease, in angioneurotic edema, and in pregnancy where there is no valvular or vascular disease. The periaortitis theory of Huchard could explain only a few cases where aortitis is shown to exist. The infectious theory, while a possible explanation in certain pulmonary infections, is entirely inadequate to explain the larger number of cases of acute pulmonary edema.

To summarize, Welch's theory appears to offer the most satisfactory explanation of pulmonary edema in a large number of instances. Experimental evidence appears to be accumulating that changes in the vessel-walls may also be an important factor.

In acute pulmonary edema, especially the recurrent form, the onset is sudden and severe. The attacks occur often at night, and the patient may be awakened with a feeling of oppression, suffocation, and fear of impending death. The dyspnea is intense, the face livid or pale and covered with sweat, as in collapse. The pulse, more often rapid and feeble, may be normal or even of high tension. Crackling or bubbling râles are heard over the lungs; in the acute form they may be more abundant over the upper lobes, while in the ordinary pulmonary edema they are more marked over the bases posteriorly. Cough may be intense or absent. Janeway calls attention to the frequency of profuse diaphoresis, diuresis, and evacuation of the bowels. In typical seizures there is an abundant, frothy, albuminous expectoration, which may well from the mouth and nose, and in severe attacks amount to 1 to 2 liters. It may be blood-tinged. The duration of such attacks varies from three to twenty-four hours. First attacks are rarely lethal; more often the patient has several, any one of which may end fatally. The expectoration and the character of the râles should differentiate it from asthma, with which especially the milder attacks of acute pulmonary edema may be easily confounded. Musser calls attention to the necessity of differentiating acute pulmonary edema from pulmonary congestion, due to acute dilatation of the heart. This may tax our diagnostic acumen. Though the signs and symptoms are more or less similar in the two conditions, their intensity is far more marked in well developed acute pulmonary edema. This intensity is shown by the more marked dyspnea and cyanosis, and the sudden flooding of the lungs, especially in its upper lobes, with fluid. The ordinary pulmonary edema associated with dropsy is usually less intense in its manifestations.

TREATMENT

Experience and experiment both show that a profound disturbance of the circulation is the chief underlying cause of acute pulmonary edema. Since experiments so frequently show a disproportion in the working power of the two sides of the heart, any rational method of treatment should aim to equalize the work of the two ventricles. The pulse tension gives the most important clinical clue to treatment. Where there is *hypertension*, and probably in those cases where the pulse appears normal, the use of vaso-dilators, as nitroglycerin, $\frac{1}{100}$ to $\frac{1}{50}$ gr. hypodermatically, is indicated. It has found favor in the hands of practically all clinicians. In addition, dry cupping of the entire chest should be practised, and where the condition is severe, venesection should be done. The withdrawal of a small amount of blood may suffice, but as much as 400 to 600 c.c. has been taken. To allay apprehension morphin sulphate, $\frac{1}{8}$ to $\frac{1}{4}$ gr. hypodermatically, with the nitroglycerin is advisable. Oxygen is useful, especially where there is much cyanosis.

Since the attacks are likely to recur, and especially at night, the nurse or even a member of the family may be taught to dry cup, and even to give the nitroglycerin and morphin, while awaiting the physician. This may save time valuable to the patient in a condition so sudden of onset and so frequently dangerous in termination. Atropin sulphate, $\frac{1}{100}$ to $\frac{1}{50}$ gr., is commonly recommended in acute pulmonary edema, and it very frequently does much good. The chief objection to its use has been its marked vasomotor stimulant influence, with consequent rise in blood-pressure. This objection loses its weight if a large dose, $\frac{1}{50}$ gr., is used. Here the influence, as pointed out by Billings, is analogous to the use of atropin sulphate in hemoptysis. Miller and Matthews find that it acts directly as a physiologic antidote in the acute pulmonary edema of muscarin, pilocarpin, and toadstool (*Agaricus muscarinus*) poisoning. They failed to find it useful in other forms of experimental pulmonary edema. Clinically, the writer would not hesitate to use atropin sulphate in acute pulmonary edema, even in the type of case under consideration, especially where the other procedures have failed to ameliorate the condition. Lindauer believed that hyoscin acted as favorably in his case as the ordinary combination of atropin and morphin.

In patients with rapid, feeble pulse and evident *hypotension*, quick diffusible stimulants, as aromatic ammonia, whisky, caffein citrate, camphor, and even digitalis, hypodermatically, are to be used. In this condition atropin sulphate, $\frac{1}{100}$ gr. hypodermatically, has not even a theoretic contraindication. Morphin, oxygen, and the dry cupping should also be used. In this connection arises the question of the advisability of using adrenalin. Kinnicutt and Forchheimer have seen it act most favorably. Meltzer and others strongly condemn its use, as it frequently, in experimental work, produced acute pulmonary edema. Since experimenters and some clinicians have found the drug capable of producing such dangerous results, it would seem advisable in acute pulmonary edema to use adrenalin injections only as a last resort. Haven Emerson,[3] as the result of experiments on animals, recommends artificial respiration in the treatment of acute pulmonary edema due to cardiac insufficiency. He finds that the rhythmic movements produce coincident variations in blood-pressure and aid the heart in the onward movement of the blood. The method was of distinct value in controlling the acute pulmonary edema produced by injections of adrenalin. Barringer[4] believes that artificial respiration was of distinct value in the treatment of a case of acute pulmonary edema occurring in a patient with mitral obstruction. In the ordinary pulmonary edema associated with subcutaneous edema, cardiac stimulants and diuretics, as digitalis, strophanthus, spartein, and potassium citrate, are usually indicated. In chronic nephritis with hypertension, nitroglycerin also is useful. In its acuter phases the methods of treatment are practically the same as outlined above. In the chronic and recurrent form, between attacks, dechloridization, by means of the salt-free diet, should at least be given a trial.

BIBLIOGRAPHY

1. Riesman: "Acute Pulmonary Œdema, with Special Reference to a Recurrent Form," Trans. Assoc. Am. Phys., vol. xxi, 1906, 155.
2. Miller and Matthews: Arch. Int. Med., vol. iv, No. 4, Oct., 1909.
3. Haven Emerson: Arch. Int. Med., vol. iii, No. 4, May, 1909.
4. Barringer: Arch. Int. Med., vol. iii, No. 4, May, 1909.

[The writer regrets, with Riesman, the dearth of literature on so important a subject. Riesman's capital contribution, with the discussion it evoked, and the articles of Miller and Matthews contain a full résumé of the history, the experimental work done, and the treatment of the condition, and constitute by far the best papers found in the literature of the subject.]

EMBOLISM, THROMBOSIS, AND INFARCTION OF THE LUNG

BY JAMES E. TALLEY, M.D.

THROMBOSIS in the pulmonary arteries dependent upon pathologic changes in their walls is rare. Embolism of a branch or branches of the pulmonary artery, causing usually sudden death, or, where the artery is smaller, causing hemorrhagic infarction or pulmonary apoplexy, is comparatively common. The origin of the emboli may be anywhere in the general venous system, thrombosis being the primary lesion. The commonest sources of emboli are: the uterus, pelvic tissues, femoral veins, right heart, pulmonary arteries, and venous sinuses of the brain. Fat emboli may arise after surgical operations or fracture of bones, especially crushing of spongy bones. Air emboli and emboli of tissue-cells, as of the liver, and new-growths occasionally occur. The commonest heart lesions causing embolism are malignant endocarditis and extreme mitral stenosis. Where small arteries are occluded, hemorrhagic infarct develops. The right lung is oftener the seat of infarcts, unless the flow of blood is in some way lessened in the right pulmonary artery, as by pleural exudate with pulmonary collapse, or fibrosis and contraction of the lung. Marked stasis in the pulmonary veins and capillaries favors infarction. When a small branch of the pulmonary artery is plugged, this stasis in the veins and capillaries prevents the establishment of a sufficient collateral circulation. The capillaries of the affected area dilate until extravasation of blood takes place and the hemorrhagic infarct is thus formed. These infarcts may vary in size from 1 to 5 cm. or occasionally involve a large portion of one lobe. Infiltration of such a large area is referred to as "pulmonary apoplexy." Usually the emboli are small, and cause multiple infarcts in the lower lobe along its posterior and inferior surfaces. An infarct is wedge-shaped, with the apex directed toward the center of the lung. When on the periphery, they involve the pleura.

The **symptoms and course** of pulmonary embolism depend upon the size of the artery occluded. Plugging of the main artery or one of its larger branches usually causes sudden death. The patient is seized with sudden intense dyspnea, the respiration and pulse become exceedingly rapid, and death ensues. Occasionally such a patient is seized with convulsions, lapses into coma, and dies in a few hours. The former succumb from paralysis of the heart, due to the sudden shutting off of its blood-supply; the latter die of cerebral anemia. In case of sudden death there is no time for the development of physical signs. Where life is prolonged for some hours, there may be found dullness at the base, bronchial breathing, or enfeebled breath-sounds.

With dilatation of the right ventricle, pulmonary congestion or edema, accompanied by large moist râles, may develop. A systolic murmur in the pulmonary artery due to the impact of the blood-stream against the obstruction may be heard just to the left of the sternum at the level of the second or third costal cartilage.

The **symptoms of infarction** are pain in the side, possibly fever, dyspnea, and a little later cough and blood-stained expectoration. During several weeks, while the infarct is undergoing resolution, hemoptysis may occur, but the amount of blood lost is usually not great. Infected emboli may cause pleurisy, abscess, gangrene, and pneumonia. Pleurisy developing in cardiac disease is frequently due to infarct. Pleurisy with exudate due to infarct may occur in cardiac disease without any other symptoms of infarct. The signs of infarct are dullness over the affected area and diminished breath-sounds, subcrepitant and crepitant râles may be found, and, if the infarct is large, bronchial breathing may be heard. Hemorrhagic infarct causes death only when the emboli are very large or very numerous. However, the outlook is grave, as the underlying heart trouble is prone to cause a repetition of the embolism.

TREATMENT

Prophylaxis is worthy of attention in certain morbid conditions where thrombosis or embolism is prone to occur. In endocarditis undue muscular effort should be avoided. In phlebitis the patient should remain at rest and the affected part be immobilized. Good contraction of the uterus should be sought after labor. In obstruction of a large branch of the pulmonary artery, death may be so sudden as to give no time for treatment. Where the plugged branch is smaller, the first indication is to support the heart by means of rapid stimulants, as caffein, camphor, strychnin, or even ammonia, ether, and brandy, hypodermatically. Morphin will allay apprehension, and in the absence of contraindicating cyanosis it may be given to ease the distressing dyspnea. Failure of the peripheral circulation calls for the application of hot-water bottles to the extremities. Dry-cupping of the chest should be practised, and where dilatation of the right heart is threatened or present, venesection is to be used. In hemorrhagic infarct the directions should be absolute rest, morphin for pain and cough, and dry cups or large sinapisms to promote the afflux of blood to the surface. For the spitting of blood, especially where the amount is large or the period prolonged, the directions given in the section on hemoptysis may be followed. Finally, the underlying cardiac condition which causes the tendency to infarction must be considered, and treated according to the general principles of cardiac therapeutics.

CONGESTION OF THE LUNGS

By James E. Talley, M.D.

This includes two different disturbances of the pulmonary circulation, and is divided into active and passive congestion. Active congestion is synonymous with acute congestion and hyperemia of the lungs. In this condition there is an increased amount of *arterial* blood in the affected area. This hyperemia may be local or general. There is usually a local congestion surrounding the affected area in inflammatory disease of the lungs and pleura, as pneumonia, tuberculosis, pleurisy, and bronchitis. The same is true in other focal lesions, as new-growths, abscess, and gangrene. This local congestion is probably inflammatory. General active congestion may occur after violent exercise, exposure to extreme heat and cold, inhalations of irritating gases, unusually severe chills, as in malaria, and possibly in disease of the pons and medulla. In extreme physical exertion the general acute congestion is probably primarily due to overaction of the heart, and if the exertion is prolonged, the congestion may become passive in type, due to heart failure. Thus, active pulmonary congestion is probably always symptomatic. The condition described by French writers as "primary acute pulmonary congestion" suggests strongly abortive or larval pneumonia. The course and termination of acute pulmonary congestion are usually favorable unless pneumonia or pulmonary edema supervenes. Sudden death in this condition, when provoked by violent physical exercise, or exposure to great heat and cold, has been attributed to the acute pulmonary congestion alone. Such a decision is tenable only after the coronary arteries and the heart muscle itself have been examined minutely and found normal.

Passive pulmonary congestion includes the mechanical and hypostatic types.

In *mechanical congestion* there is obstruction to the outflow of venous blood from the lung. A weak right ventricle, and obstruction or incompetence in the left heart, are the chief causes. Myocardial trouble of any sort is apt to cause some degree of passive congestion, which is usually general. Tumor or aneurism, by compressing pulmonary veins, may cause a local passive congestion. The morbid change mechanical congestion produces in the lung tissue is known as "brown induration." Its symptoms are dyspnea, cough, and expectoration, in which are strongly pigmented alveolar cells and eosinophiles. Its course and duration depend almost solely upon the ability or inability of the heart to regain its efficiency.

Hypostatic congestion occurs in patients kept for a long period in a recumbent position. Adynamic states, as typhoid, fractures, especially in the aged, coma, as in apoplexy, brain injury, and morphin-poisoning, are among the causes. It is usually attributed to gravity, but in such weakened patients sluggish respiration, prolonged muscular inaction, feeble heart, and lessened elasticity of vessels are also important factors. The development of dyspnea, cyanosis, increased fremitus, percussion dullness, and moist and crepitant râles at the bases of the lungs fix the diagnosis. In the old, the feeble, and children the mortality is high.

TREATMENT

The treatment of both active and passive congestion is largely the same. Dry cups should be applied over the pulmonary area, especially in the acute form, and other local measures, as cold compresses, the ice-bag, or the hot-water bag applied to the spine, according to the method of Kinnear, as described in the treatment of hemoptysis, are to be considered. Except in the hypostatic form, complete rest is essential. The diet should be concentrated and semi-liquid or liquid. In mechanical congestion the treatment should be directed to the underlying cardiac condition. Digitalis is needed, and the same precautions as advocated in the treatment of cardiac disease should be taken to secure a reliable preparation. A fresh infusion of leaves, Nativelle's digitalin granules, the tincture, preferably fat-free, and possibly some of the standardized preparations, as digitalone, may be used by mouth. Where urgent, the tincture or digitalone should be used hypodermatically. Nativelle's digitalin granules, $\frac{1}{240}$ gr., are commended where an accurate and active preparation is needed in small volume; but if given, it should be borne in mind that one granule every eight to twelve hours is sufficient. Rapidity and low tension of the pulse indicate the use of digitalis, and the condition of the pulse is a guide to the frequency of its repetition. Marked cyanosis, distended systemic veins with increasing rapidity and feebleness of the pulse mean cardiac dilatation, and venesection, with the withdrawal of at least 15 to 20 ounces of blood, should be done at once. In extreme cases even aspiration of the right auricle with a fine needle has been suggested. The venesection should be followed at once by diffusible stimulants. Aromatic spirits of ammonia, 30 drops every half hour, is good. Ammonia carbonate, 5 gr., in mucilage of acacia, every one or two hours, is a little more persistent. These preparations are short-lived in their action and in time irritate the stomach. Where the condition is serious and more efficient and prolonged stimulation is desirable, caffein citrate and camphor, especially hypodermatically, are recommended. Caffein citrate should be given in doses of 1 to 3 gr. every three to four hours. For hypodermatic use a preparation of caffein sodiobenzoate is recommended by Babcock. It is made thus: caffein, 5 gr.; sodium benzoate, 8 gr.; distilled water, 50 mm.; 10 mm. contain 1 gr. of the alkaloid. The dose of camphor is from 1 to 3 gr., every three to four hours, and when used after venesection, as we desire its rapid action, it is better given hypodermatically. For this purpose a 10 per cent. solution in sterile olive oil is usually recommended. Ten mm. contain 1 gr. of the gum.

Though strychnin and alcohol have been so largely used as quick cardiac stimulants in such conditions, there is a tendency to regard caffein and camphor, especially the former, as more potent and satisfactory. Morphin, codein, and heroin are useful to allay cough and sedate the nervous system in any form of pulmonary congestion. Aged and adynamic patients confined to bed should have their positions changed every hour or two. Careful watch should be kept of the bases of the lungs, as hypostatic congestion develops insidiously. At the first suggestion of its approach, dry cups, digitalis, strychnin, and diffusible stimulants in moderation should be used. In both mechanical and hypostatic congestion when the patient is not too feeble, brisk purgation, as with a saline, may do great good by determining blood from the pulmonary to the abdominal area.

ATELECTASIS OR PULMONARY COLLAPSE

By James E. Talley, M.D.

Atelectasis or pulmonary collapse is a condition in which parts of one or both lungs, or even an entire lung, are empty of air and the alveoli and terminal bronchials collapse. The factors producing this condition are deficient inspiratory force and obstruction of bronchi within or compression without. Any of these factors alone may produce atelectasis or several may be operative. In any case, in complete collapse, a fourth factor is always present, the absorption of the residual air by the blood flowing through the collapsed area. Atelectasis of the new-born may be either congenital or acquired. In the former the affected lung tissue remains unexpanded; in the latter the lung tissue expands after birth, but again collapses and returns to the antenatal condition. The causes are natural weakness of the infant or premature birth, rendering the respiratory muscles too feeble to elevate the thorax during respiration, intracranial lesions produced by prolonged labor, or forceps causing paralysis of the respiratory center, and asphyxia, due to obstruction of the air-tubes by vaginal secretion or meconium. Acquired atelectasis due to feeble respiratory efforts occurs in typhoid and other adynamic states. Prolonged rest in one position favors its development, and the collapse may be a precursor of hypostatic congestion. Atelectasis due to obstruction results from the lodging of a foreign body in the air-passages, and occurs in such diseases as capillary bronchitis, bronchopneumonia, measles, and whooping-cough. The obstruction arises from retained secretions and congestion of the bronchial mucous membrane. Compression of the bronchi or lung causing the collapse arises from pleural and pericardial effusion, thoracic aneurism, new-growths, and enlarged glands. Spinal deformity and intra-abdominal growths are also possible factors. The site of collapse is usually the lower lobes, especially their inferior borders. In atelectasis of the new-born where a small area is involved, it may be easily overlooked. If there is no intracerebral condition, the outlook is good. Where the area is large, the child is cyanotic, the respiration rapid and feeble, and the cry weak. Occasionally convulsions precede death.

In these large areas, especially if combined with intracranial lesions, the outlook is bad. In the other forms any symptoms are apt to be overshadowed by those of the primary complaint causing collapse. Physical signs are more helpful in arriving at a diagnosis. But even these may fail where the collapsed area is small, because of the surrounding compensatory emphysema. Given one or more of the causative factors enumerated, collapse is assured where there is a definite area of dullness at the base, weak bronchial or lessened respiratory murmur, bronchophony, increased tactile fremitus, and crepitant râles, all of which yield to resonance, vesicular breathing, and disappearance of râles after several deep inspirations alone or combined with change in posture. The outcome of the condition depends upon its cause and extent. In adynamic states, in capillary bronchitis and bronchopneumonia, the collapse usually disappears with the recovery of the child. The outlook in atelectasis due to pressure depends upon the possibility of the removal of the cause of the pressure before there is time for the development of inflammation or fibrosis with permanent contraction.

TREATMENT

In atelectasis of the new-born, first of all the nose and throat should be cleared of the vaginal discharge. Deep inspiration should be excited by the sudden application either of hot and cold water alternately, or of cold water alone, to the thorax. If this fails, gentle inflation of the lung through a soft-rubber catheter passed into the larynx should be tried. The child should be surrounded with artificial heat, and if it can swallow, a few drops of whisky or of aromatic spirits of ammonia in water should be given. The posture of patients in adynamic states should be changed several times a day. Even semi-comatose typhoid patients will take deep inspirations on command. Spinal curvature should be corrected as much as possible, and such patients should be taught respiratory exercises. In capillary bronchitis, the ordinary bronchitis of pertussis and measles, and in bronchopneumonia, ammonia carbonate or chlorid should be given to lessen the viscidity of the secretion. Where the bronchitis persists, small doses of iodid are even more efficient. Codein, heroin, or morphin to lessen the cough must be used judiciously, if at all, as the expiratory effort of coughing tends to re-expand the collapsed tubercles. Since children do not understand the necessity of making voluntary efforts to expel the secretion, where it is abundant, and the strength permits, an occasional dose of syrup of ipecac or apomorphin may be advisable. When the primary disease has subsided, complete re-expansion of the collapsed area should be sought. A daily shower of cold water against the neck and thorax provokes deep inspirations. The child may be placed standing in a bath-tub and the ordinary rubber spraying apparatus, common to every bath-room, used for the purpose. The temperature of the water, especially at first, may be varied according to the strength and reaction of the patient. Breathing exercises should be taught when the child is old enough. Where the child remains weak and the local signs unsatisfactory, there remains a change to an elevated climate, or the use of the pneumatic cabinet, or breathing of compressed air. The special forms of apparatus and the principles underlying their use are fully discussed in the article on pneumotherapy, volume x of Solis-Cohen's "System of Physiologic Therapeutics."

It is necessary only to mention the use of tonics, and attention to diet suited to improve the general health.

TREATMENT OF TRACHEAL AND BRONCHIAL OBSTRUCTIONS

By Chevalier Jackson, M.D.

For the consideration of treatment, tracheal and bronchial obstructions may be classed under three heads.

1. Functional obstructions: (*a*) "Bronchial asthma"; (*b*) angioneurotic edema.

2. Endotracheal or endobronchial obstructions: (*a*) Neoplasms; (*b*) secretions; (*c*) scleroma; (*d*) inflammations; (*e*) infective granulomata; (*f*) cicatrices; (*g*) foreign bodies.

3. Peritracheal compressive obstructions: (*a*) Aneurism; (*b*) mediastinal neoplasms; (*c*) effusions; (*d*) adenopathy; (*e*) gumma; (*f*) cervical goiter; (*g*) intrathoracic goiter; (*h*) thymic hypertrophy.

Horn, Galebsky, and Nowotmy have treated cases of **asthma** by the direct application of 20 per cent. cocain with a small amount of epinephrin direct to the bronchial mucosa with relief for considerable periods. What proportion of cases of "bronchial asthma" are amenable to this measure it is impossible to say. In the present state of our knowledge it will, of course, be reserved for urgent cases, that have long resisted ordinary medicinal treatment. **Angioneurotic edema** of the bronchi has been observed by T. H. Halstead. No treatment other than the systemic was used. Membrane or tough secretion seems occasionally to play an important part even in paroxysmal dyspnea. Bronchoscopic clearing with forceps, swab, or aspirator has sometimes had the happiest result, as demonstrated by Ingals and Winslow.

Endotracheal neoplasms may be removed entire in the case of small benign growths, such as papillomas, by bronchoscopy through the mouth. Mechanically it is quite feasible to remove malignant growths of limited extent, but the procedure offers no hope of prolonging life, and hence is not advisable.

Tracheal and bronchial occlusion with pus and secretions in a patient who cannot expectorate, such as an adult with some forms of paralysis or an infant naturally incapable of expectoration, may actually result in the drowning of the patient in his own secretions. Such cases, as the author has demonstrated many times, may be promptly relieved by upper bronchoscopy and the cleaning out of secretions with swab and aspirator. In case of a child relief may also be obtained by holding it up by the heels for a fraction of a minute every few hours, as indicated. Tracheotomy as a last resource has saved many lives. An expert nurse is necessary quickly to wipe away secretions before they are indrawn.

Scleroma of the upper trachea and its associated laryngeal lesion have been successfully treated by radiotherapy, the larynx being extensively laid open for the purpose, as suggested by Emil Mayer.

Inflammations.—Obstructive edema of the trachea is usually secondary to acute or chronic chondritis of traumatic or infective origin. The primary infection may have been luetic, tubercular, typhoid, diphtheritic, etc., but it is usually the secondary mixed infections that do the damage and result in cicatricial stenosis. Hence early drainage and antiseptic treatment of pus foci are indicated. In acute edematous tracheitis, associated with these diseases or with influenza, the inhalation of a spray of adrenalin, 1 : 5000, is of service, and depletion by incision of puffy swellings through the bronchoscope will lessen obstruction. Ice externally lessens the severity of acute inflammatory conditions. Tracheotomy must always be prepared for, and should be done promptly when indicated, erring, if at all, on the side of earliness rather than lateness.

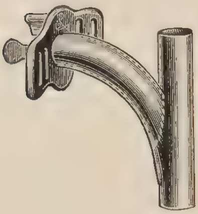


Fig. 1.—The author's laryngostomy canula. The soft-rubber dilatatory drainage-tubes are attached to the upper or lower extremity of the straight portion, or to both extremities.

Cicatricial stenosis of the trachea associated with a similar condition in the larynx is very successfully treated by the operation of laryngo-tracheostomy, which consists in laying open the larynx and trachea and in producing a sloughing of cicatricial adhesions by the elastic pressure contact of a soft-rubber dilating drain (cut from catheters, human and veterinary) which lies in the lumen of the larynx and trachea and which is held in place by a braided silk thread, the upper projection of the tracheal canula (Fig. 1) being inserted into the end of the tubing. The sizes are increased every day or two, until the limit of about No. 42, French scale (for an adult), is reached. Should the sphacelic process become excessive, the diameter of the dilatatory drain is decreased to the last preceding size for a few days, when the increase is resumed. This sphacelic removal of the cicatricial tissue has been found preferable to excision, which is usually followed by worse and worse cicatrices. The treatment is prolonged, requiring

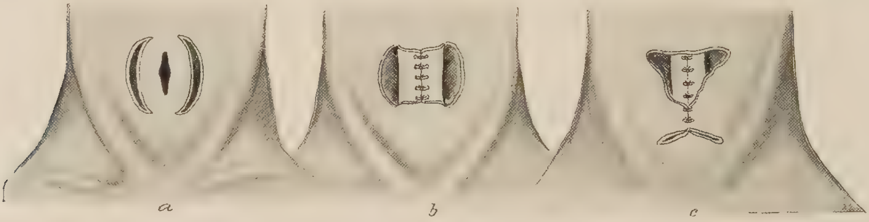


Fig. 2.—Schema of the autoplastic operation for closing the tracheodermal fistula after tracheostomic cure of cicatricial tracheal obstruction: *a*, Elliptic incisions around the fistula; *b*, flaps turned epidermis inward and sutured; *c*, drawing together of the skin to cover the flaps.

from six months to a year, the object being to get rid of the cicatricial tissue and then to get the interior of the larynx and trachea lined with epidermal epithelium, a process which in the author's experience has seemed to be hastened by applications of scarlet red in a 10 per cent. ointment with petrolatum. After the epidermatization of the laryngotracheal lumen is complete and the tendency to contraction has ceased, the wound is closed by a flap of skin turned over, epidermal surface inward, as is readily understood by reference to the cut (Fig. 2). The epidermal surface turned in assumes mucosal duty, but hair-bearing epidermis must be avoided. Should there be a loss of the cartilaginous ring-structure, a flap containing a fragment of rib cartilage may be turned up and sutured in place. Sloughing out of the stitches occasionally occurs, necessitating reoperation in part. The flaps must, of course, be well freed so that there is no tension. Tracheostomy is well adapted to the treatment of cicatricial stenosis following the trauma of attempted suicide. It is, manifestly, in any case only applicable to stenosis of the cervical trachea. *Cicatricial stenosis* of the deeper trachea is amenable only to palliative treatment by the long tracheal canula (Fig. 3). The ordinary canula will not reach the thoracic trachea and the patient has often died unrelieved by tracheotomy. Very promising results have been obtained by Brunning's and von Schroetter's tracheal and bronchial intubation tubes, inserted with the aid of the bronchoscope. They are placed through the bronchoscope and are watched bronchoscopically and radiographically or fluoroscopically. These have been used in the larger bronchi as well as in the trachea, and with less risk.

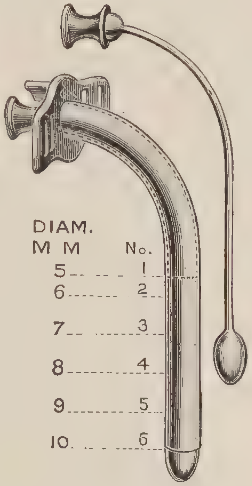


Fig. 3.—Long tracheal canula for tracheal compressive stenoses. The longer lengths will intubate the main bronchi.

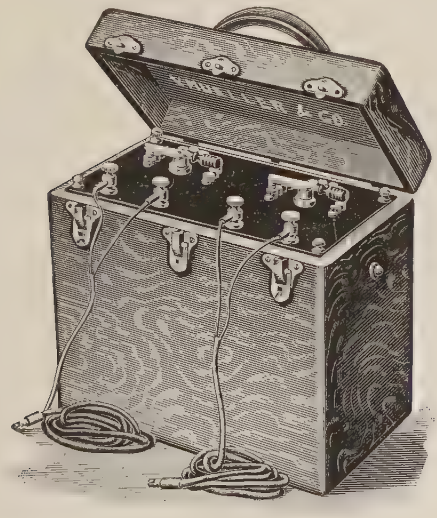


Fig. 4.—Author's double battery, insuring safety in bronchoscopy.

Tracheal obstruction from exuberant granulations due to necrotic cartilage from traumatism is quickly cured by the endoscopic application of a 10 per cent. solution of argentic nitrate or resorcin.

The treatment of **compression stenosis** of the trachea manifestly depends upon whether or not the compression is removable. The compressions by aneurism, mediastinal malignancy, and similar conditions partake of the hopeless character of the basic condition. Compressions by effusions are relievable. Compressions by adenopathic masses, when due to lues, are susceptible of great improvement by general medication, and any case of uncertain diagnosis justifies antiluetic treatment, especially by the iodids. Tubercular adenopathic compressions rarely disappear, though the modern anti-tubercular régime will often lessen the stenosis greatly. The stenosis due to the ulceration through a bronchial wall by a broken-down gland may get well after the expulsion or bronchoscopic removal of the cheesy material.

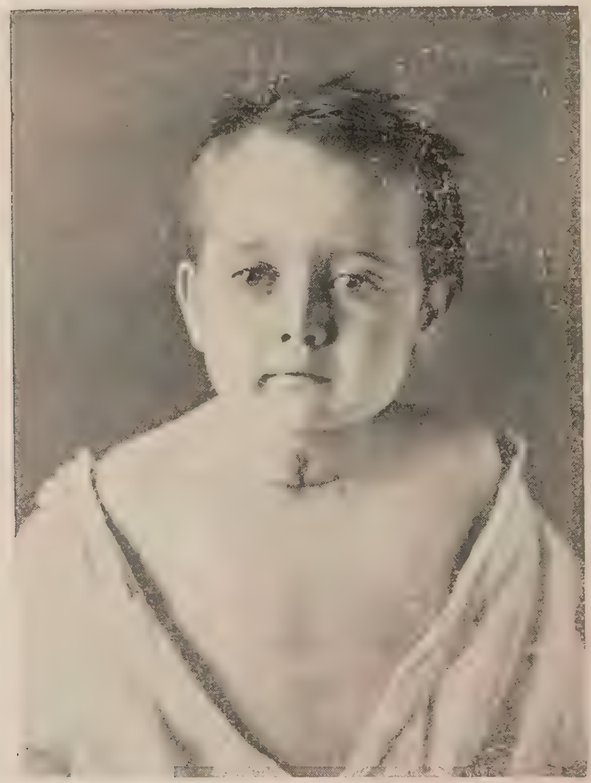
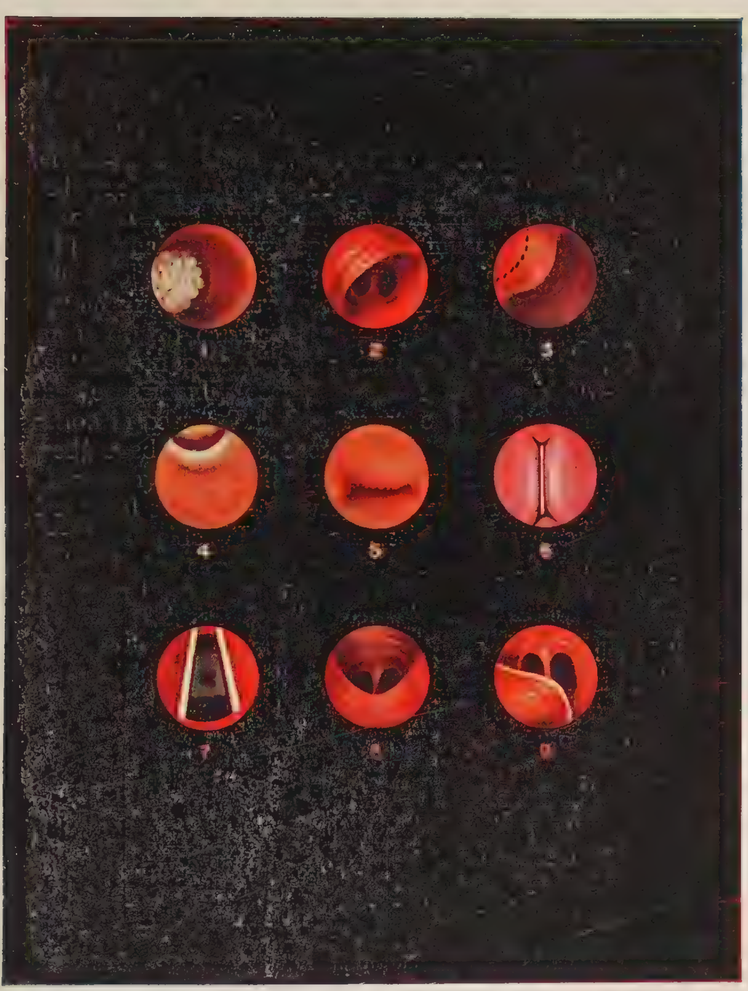


Fig. 5.—From a photograph of patient four months after thymectomy for thymic tracheo-stenosis in a boy of four years (author's case).

Cervical goiter is one of the most frequent causes of tracheal obstruction, and is, of course, curable by excision. A much more serious degree of tracheal obstruction, though of less frequent occurrence, is associated with intrathoracic goiter. Extirpation is usually quite

PLATE I



VARIOUS FORMS OF TRACHEAL OBSTRUCTION.

1.—Tracheal papilloma in a girl of 4 years. Removed by bronchoscopy through the mouth.
2.—Tracheal obstruction due to compression by goiter.
3.—Tracheal compression by aneurism. Dotted line shows extent of pulsatory excursion. (Many of these compressions do not pulsate markedly.)
4.—Cicatricial stenotic web in the trachea resulting from ulceration caused by a foreign body in the esophagus. Child 2 years of age. Stricture cured by divulsion.
5.—Scabbard trachea. Thymic tracheo-stenosis. Cured by thymectomy. Child of 4 years. (See Fig. 5.)
6.—Egg-shell fragment in edematous larynx. Infant of 9 months. Removed through the mouth.
7.—Button fixed in the trachea by the swollen mucosa. Boy of 14 years.
8.—Luetic cicatricial tracheal stenosis. Cured by tracheostomy.
9.—Compression stenosis of the trachea by an esophageal carcinoma. Man aged 60.

feasible, by insertion of the finger behind the sternum, compression of the trachea being meanwhile prevented and easy breathing being assured by insertion of the long tracheal canula (Fig. 3).

It was for years a mooted point whether or not the soft thymus gland could compress the trachea, the element of venous engorgement and subsequent recession before the autopsy in the "status lymphaticus" cases being overlooked. It was the author's privilege to demonstrate endoscopically in the living patient that such compression occurred, and that the compressive tracheal stenosis was cured by thymectomy (Fig. 5). The gland was brought up out of the thorax by the little finger inserted down behind the sternum, the breathing being assured and general anesthesia being rendered safe by the long tracheal canula (Fig. 3) reaching to the bifurcation. Thymopexy - the anchoring of the gland upward and forward out of the thorax—has been successful, as has also radiotherapy.

Foreign bodies often cause tracheal and bronchial obstruction, sometimes by their shape and bulk, but more often by the secondary changes incited by their presence.

OBSTRUCTION OF THE TRACHEA AND BRONCHI BY FOREIGN BODIES

The methods available for the removal of foreign bodies are: (1) Inversion of the patient; (2) tracheotomy; (3) thoracotomy; (4) fluoroscopically guided forceps; (5) bronchoscopy.

Inversion of the patient is available only in children, the child being held up by the feet to obtain the aid of gravity. It can be successful only when the intruder is heavy and is free to move. It is exceedingly dangerous unless an expert and prepared tracheotomist is at hand, for glottic spasm is almost certain to supervene when the foreign body strikes the under surface of the cords, and respiratory arrest will be quickly fatal unless the trachea be opened. Tracheotomy for the removal of foreign bodies is only justifiable in districts remote from large medical centers where the services of a skilful bronchoscopist may be obtained. It is associated with little risk when the foreign body is located high in the trachea or is coughed out. Blind groping in the deeper air-passages with forceps passed down through the tracheotomic wound is often fatal from trauma, and moreover is rarely successful. A cystoscope passed through the tracheotomy wound permits of careful work with cystoscopic forceps under guidance of the eye, and has been frequently successful and really constitutes a lower bronchoscopy. Any procedure through the tracheotomic wound should be done immediately after the tracheotomy, if at all. After the usual mixed infection of the wound, the infective risk of instrumentation in the deeper air-passages is increased. Strictly aseptic technic is, in any event, imperative. Modern skill in upper bronchoscopy has rendered all these methods crude by comparison.

Thoracotomy is only indicated in the very rare instances when bronchoscopy has failed, and because of its high mortality it is strongly contraindicated prior to abscess formation. When a radiograph locates an abscess close to the periphery, and bronchoscopy has failed either to evacuate the abscess or to remove the foreign body, and especially when extensive adhesive pleuritis has made a pathway for the surgeon, thoracotomy has yielded good results. Its technic is elsewhere herein considered. Extraction of a bronchially lodged foreign body by seizing it with forceps guided by their shadow upon a fluoroscopic screen has been very ingeniously and successfully used by Bowen, Huber, Morris and others. The method is available where the foreign body is very opaque to the ray. A tracheotomy for the introduction of forceps is necessary, and great care must be taken to avoid fatal trauma by grasping a spur which may be in line with, but not in the same plane as, the foreign body. Bowen has devised a table to minimize the risk to the operator.

Bronchoscopy.—Bronchoscopy is a procedure using straight tubes which serve as specula in pushing aside structures which normally obstruct the view, or dragging the air-passages into a new position where they will be in the direct line of vision. It is called lower bronchoscopy when the tubes are passed through a tracheotomic wound, and upper bronchoscopy when done through the mouth. In the early days the lower route was frequently resorted to, but modern skill and instrumental improvement have limited lower bronchoscopy to severely dyspneic cases. Upper bronchoscopy is a bloodless procedure by which over 95 per cent. of the foreign bodies aspirated into the lower air-passages can be removed if seen within a few weeks of the accident. Later, the percentage of successes is somewhat less, but the mortality in any event is very low, probably not over 3 per cent. In the author's first one hundred cases of bronchoscopy, only one patient died from any cause whatever within thirty days. The great safety of the procedure lies in the fact that every step is under the guidance of the eye. Obstructions due to aneurism are discovered and the tube withdrawn without touching them. The extreme degree of flexibility of the tracheo-bronchial tree as demonstrated by Killian, the originator of bronchoscopy, renders endoscopy feasible and safe.

Anesthesia.—Bronchoscopy is almost painless, but the reflexes, especially cough, are so troublesome as frequently to require anesthesia for careful work. For diagnosis or local treatment in children no anesthetic, general or local, is required. In adults cocain locally, preceded for twenty-four hours by large doses of sodium bromid internally, suffices for all cases for diagnosis and local treatment; but for accurate work in the removal of neoplasms and foreign bodies general anesthesia is often needed. It is contraindicated in all cases of dyspnea. Dyspneic cases are best handled by immediate insertion of the bronchoscope, which will promptly relieve all dyspnea except in case of a foreign body very large in one plane which turns transversely, causing occlusion like a "butterfly-valve." In such a case the operator must quickly seize and remove the foreign body or hold it in such position as to permit free passage of air. Unless the operator is facile at tracheotomy and bronchoscopy, either or both, it is far safer preliminarily to tracheotomize all dyspneic cases, as respiration once arrested in these cases will not be reëstablished without tracheotomy followed by artificial respiration. Anesthesia through a canulated tracheal wound is relatively safe. The author's preference when general anesthesia is to be used in bronchoscopizing dyspneic cases is to insert the bronchoscope to relieve the dyspnea, and then administer the anesthetic by the vaporizing apparatus of Brophy or the dosimetric apparatus which was attached to the bronchoscope at the suggestion of T. Drysdale Buchanan (Fig. 6). With patients not dyspneic the anesthetic, chloroform or ether, may be started by the open method in the usual way and continued by means of the Buchanan apparatus. When a local anesthetic is to be used, the pharynx and epiglottis are swabbed with cotton saturated with 4 per cent. cocain solution held in the Sajous laryngeal forceps, just as an anesthetist would swab out the pharynx without special illumination.

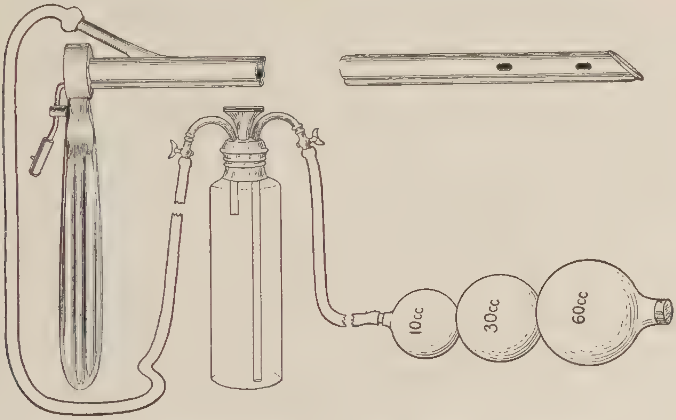


Fig. 6.—Dosimetric anesthetic attachment for bronchoscopy. Suggested by T. Drysdale Buchanan.

Waiting a few minutes, the speculum is passed, the upper laryngeal orifice is exposed and sponged with a 20 per cent. solution of cocain, using a little fold of gauze held in the Coolidge sponge-holder. In this way only a small amount of the strong solution (which is necessary in the larynx and deeper air-passages) is used. After anesthetizing the larynx the swab is passed through the glottis and the subglottic mucosa is anesthetized. Below this the anesthetizing swabs may be passed through the bronchoscope after the latter is introduced, or an atomizer may be used previously through the slide speculum. Large doses of sodium bromid used prior to anesthesia will greatly lessen the amount of cocain needed to control coughing. Cocain is absolutely inadmissible in children, as are also morphin, heroin, codein, and similar antibechics.

Technic of Bronchoscopy.—The strictest aseptic technic is imperative, else we may infect our patient with tuberculosis, diphtheria, lues, influenza, etc.; and should the patient subsequently develop a septic pneumonia, we may know that the infection was carried in by the foreign body and not by our instruments. The introduction of the bronchoscope, unlike the placing of all other forms of specula, requires considerable practice, but the knack once acquired the procedure is easy and requires but a few seconds.

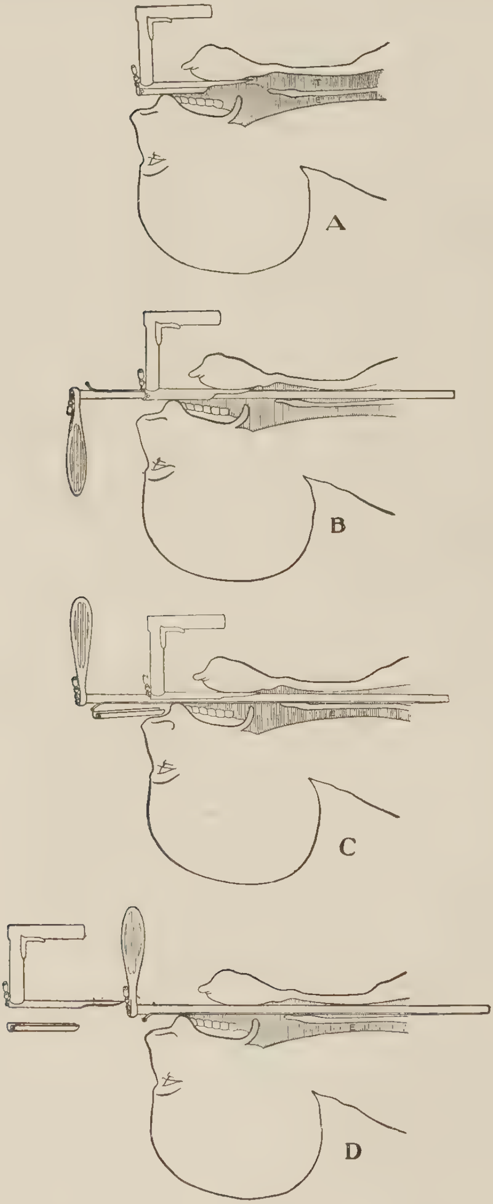


Fig. 7.—Schema illustrating upper tracheo-bronchoscopy: A, Separable speculum in position; B, bronchoscope passed through separable speculum; C, slide of speculum removed; D, separable speculum removed, leaving bronchoscope in position.

The general mechanism of introduction will be clearly understood by reference to the cut (Fig. 7). The electrically illuminated slide speculum (which is separable) is introduced, its distal end passed posteriorly to the epiglottis, and all the tissues attached to the hyoid bone are dragged anteriorly (upward in the dorsally recumbent patient), and the glottic chink is exposed. The facile operator will usually pass the slide speculum down the side of the tongue, rather than over the dorsum, thereby gaining space, but the less experienced will find orientation less easy in the lateral than in the dorsal passage. This exposure of the glottic chink is the part of bronchoscopy that requires practice. It is easy when once learned. It brings the tracheal axis in line with the operator's visual axis. It can be accomplished only when the head is held in the proper position. The early work was attempted in the Roser position, in which the head dependent over the head of the table placed the cervical vertebræ in a curve, the convexity anteriorly, thus rendering bronchoscopy almost impossible. The Boyce position (Fig. 8) renders bronchoscopy easy. The shoulders of the patient are brought to the edge of the head of the table, the head being supported out in the air by the assistant, where the head is free to be moved in all directions by the operator. The head, instead of dropping over the edge of the table as in the Roser position, is elevated, thus straightening the cervical spine. The extension is all at the occipito-atlantal joint, being facilitated by the left thumb of the assistant, the fingers and palm being back of the patient's head. In order to prevent fatigue, the assistant's left arm rests on his own left leg, the corresponding foot being upon a stool, the top of which should be about 26 inches below the top of the operating table. Arranged thus, an assistant may hold the head for hours without fatigue.

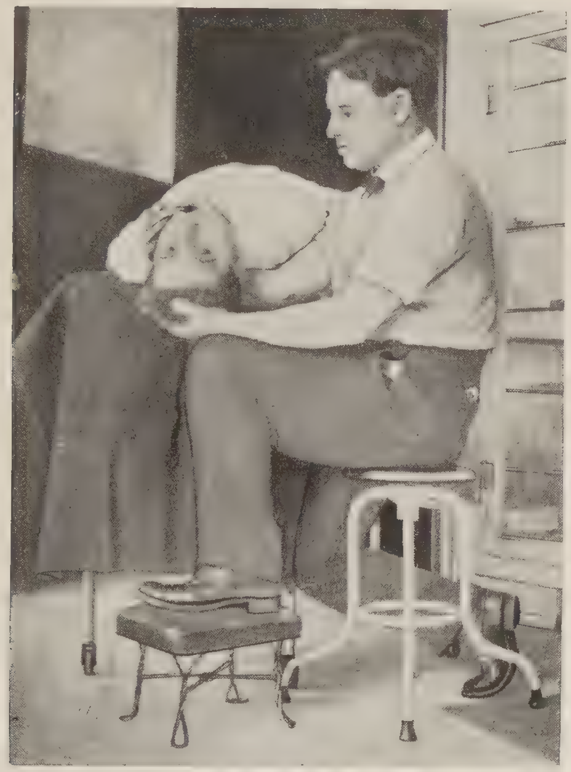


Fig. 8.—The Boyce position for the patient and second assistant during upper bronchoscopy.

The glottic chink being exposed by the slide speculum, as shown schematically at A in Fig. 7, the bronchoscope, illuminated by a separate electric circuit through its own cord, is passed down almost to the cords, which, however, it does not touch. The extended lip of the slanted end is kept in correspondence with the long axis of the chink during insertion. An inspiratory excursion is waited for, and when the

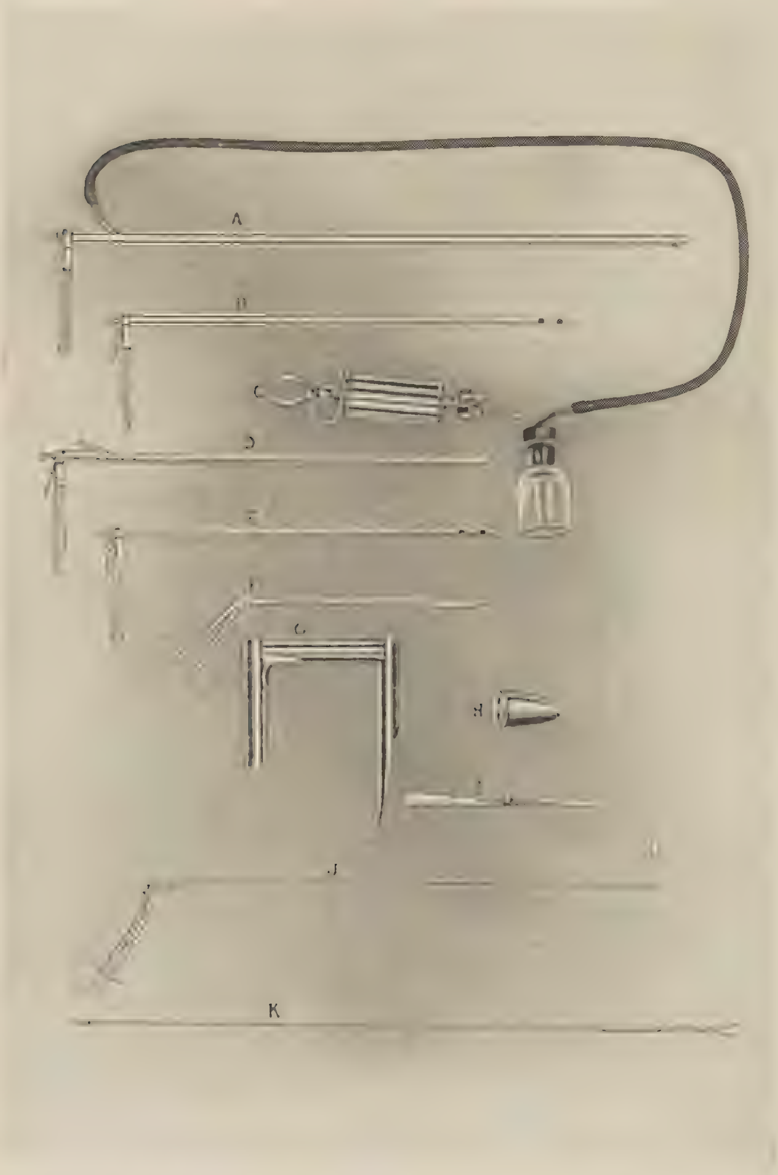


Fig. 9.—Instruments for bronchoscopy. A is actually an esophagoscope, but it illustrates the aspirating attachment used on the bronchoscope in cases of excessive secretion. B and E, bronchoscopes; F, Mosher's laryngeal forceps; G, slide speculum; H, Boyce's thimble gag; I, Sajous' laryngeal cotton forceps; J, author's foreign-body forceps; K, Coolidge sponge-holders.

abductive motion starts, the distal end of the bronchoscope is quickly intruded into the trachea (B, Fig. 7), passing down far enough that the slide speculum may be removed without chance of accidentally withdrawing the bronchoscope. Care must be taken that the head is so manipulated that the axis of the bronchoscope follows the axis of the trachea, else the distal end of the bronchoscope will impinge on the tracheal wall. The bronchoscope being introduced into the trachea, the slide speculum used for introduction is no longer needed, and is removed by removing the slide (C and D, Fig. 7). The slide speculum is quite heavy, so that there is no need of a gag, which would interfere with exposing the larynx, not by its bulk, but by jamming the inferior maxilla down on the hyoid bone. The bronchoscope, as befits an instrument to be used in the interior of delicate structures like the lungs, is very light and delicate. To prevent the patient biting it, the Boyce thimble is used upon the first right finger of the assistant who holds the head.

Having entered the trachea, the ramifications of the tracheo-bronchial tree are explored under guidance of the eye. Passing down the trachea the first landmark discernible is the carina or spur at the bifurcation. Thence into one or the other main bronchus is optional, the patient's head being moved to the opposite side. The tube passes on down readily until

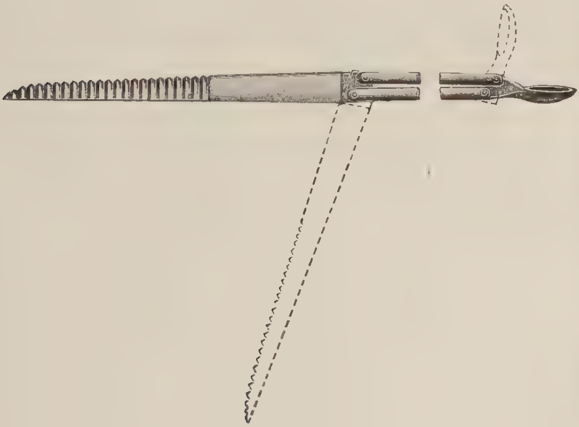


Fig. 10.—Author's mechanical spoon for the removal of friable bodies, which may be, with it, drawn into the tube mouth without crushing.

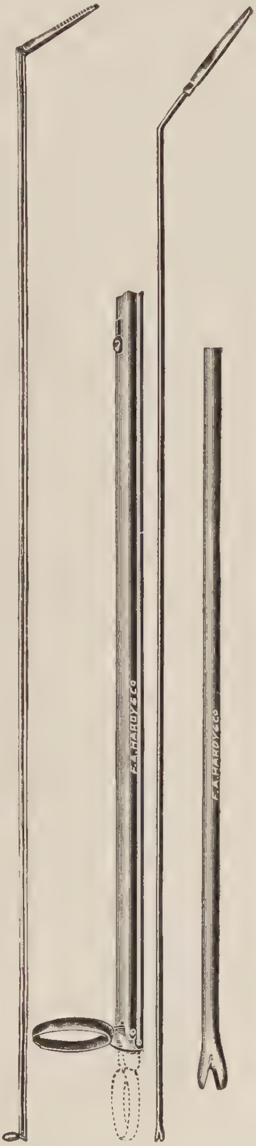


Fig. 11.—The author's safety-pin closer for closing open safety-pins before removal.

stopped by the decreasing lumen of the inferior lobe bronchus. The upper lobe bronchus, especially the left, in some instances presents some difficulties in entrance; but by inclining the patient's head and neck far to the opposite side, the upper lobe bronchus can readily be entered, though its rising branches cannot be explored. Fortunately these are rarely the site of lodgment either of foreign body or of disease, except tuberculosis.

Small bodies or those that, like pins, are small in one diameter may drop into very small bronchi, which may entirely close temporarily from mucosal swelling or permanently from organization of granulation tissue following sloughing or ulceration. In such instances it may be impossible to find the intruder, until after extensive abscess formation.

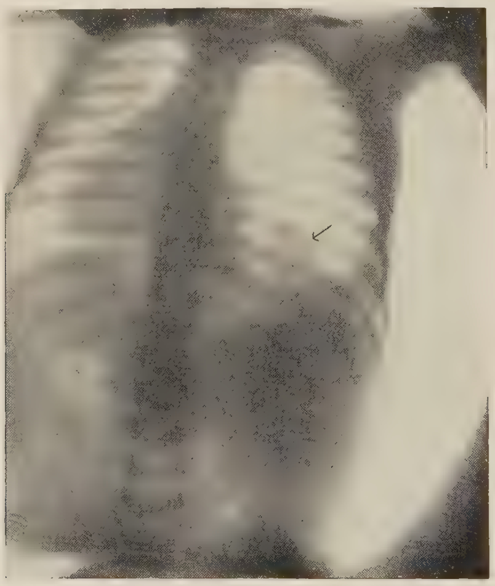


Fig. 12.—Radiograph showing abscess in right lung due to obstruction of the lower lobe bronchus by a peanut aspirated about one month before. Peanut removed and abscess thus evacuated bloodlessly through the mouth by bronchoscopy.

Usually the pathway to the foreign body is blazed by the signs of mucosal inflammation, redness, swelling, and hypersecretion. Normally the mucosal color is that of the inside of the cheek, with the site of the rings of the trachea and larger bronchi showing out somewhat paler. Almost all foreign bodies are most readily seized with the strong but delicate forceps shown at E in Fig. 9. They are so light that they permit of the most delicate sense of touch and their every movement can be watched through the tube. The jaws can be seen to close on exactly the desired part of the foreign body. If, as very frequently happens, the intruder is too large to be withdrawn through the tube, the bronchoscope, forceps, and foreign body are all withdrawn together, the forceps being used to draw the intruder closely against the distal end of the tube in order to lessen the chance of its being stripped off by the glottis.

The side harboring the intruder is often red and velvety, so that the rings cannot be distinguished. In the case of a foreign body which is free to move and that has been cast about from one bronchus to the other until the time of the bronchoscopy, both main bronchi may be inflamed. If impacted in a small bronchus, usually bubbles of secretion emanating from the invaded bronchus will guide the bronchoscopist. Removal of foreign bodies by bronchoscopy requires in some instances an extreme degree of mechanical ingenuity safely to remove the foreign body without injury to the patient. Rough and ill-planned efforts court disaster. Soft friable bodies, like beans, peas, nut kernels, etc., must not be grasped with forceps, lest they be crushed and produce multiple abscesses from scattered minute fragments. They should be drawn into the tube-mouth with the mechanical spoon (Fig. 10). Pins which have become transfixed across the bronchial lumen require cutting with Casselberry's forceps, which are so ingeniously devised that the two pin fragments are safely held after cutting. Safety-pins lodged point upward must be closed before removal. This may be done with Mosher's or with the author's pin-closer (Fig. 11). Hooks of various shapes are occasionally of use, but, as pointed out

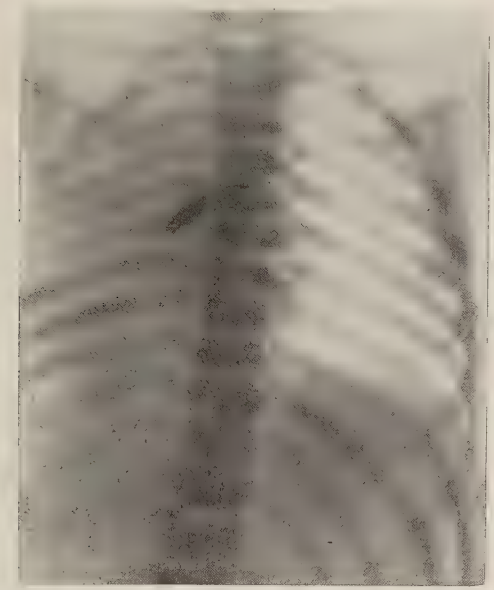


Fig. 13.—Radiograph showing atelectasis and pneumonia due to obstruction of the right bronchus by the leg of an alarm clock, in an infant.

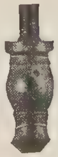


Fig. 14.—Leg of an alarm clock removed bloodlessly through the mouth by bronchoscopy.

by Ingals, must be used cautiously lest they get caught in a lateral branch bronchus beyond view; and in view of such possibility they should have a flattened or otherwise proximal end to indicate the plane of the hook. A long snare armed with No. 6 piano wire, as suggested by Ingals, is a very useful instrument for seizing large bodies.

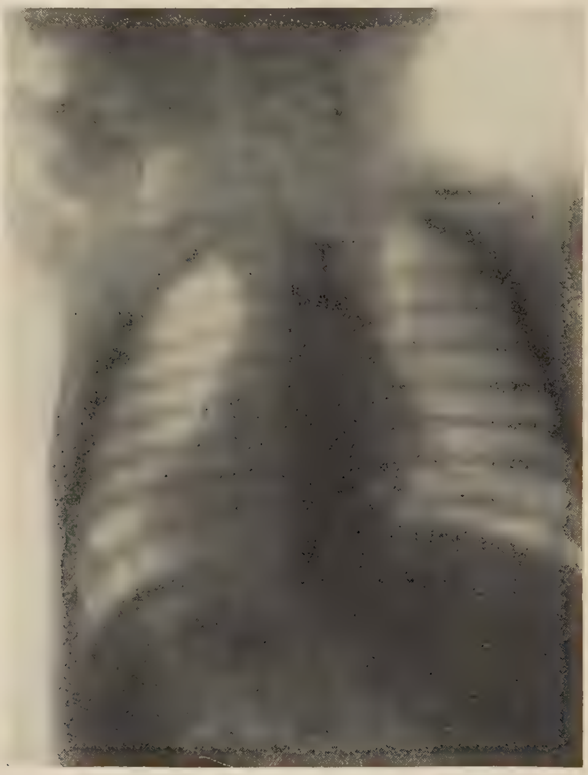


Fig. 15.—Radiograph of an infant of six months, showing a cuff-button which in three months ulcerated through from the esophagus into the trachea, causing almost fatal tracheal obstruction. Removed bloodlessly through the mouth by bronchoscopy without anesthesia.

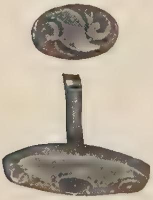


Fig. 15 *a*.—Cuff-button shown in Fig. 15.

Pulmonary abscess may be evacuated bronchoscopically. In such a case an abscess (Fig. 12) was evacuated by the author in removing a peanut kernel which had probably been *in situ* for over a month. Foul necrotic sloughs were liberated by removal of the obstruction, and such a quantity of pus that the infant was almost drowned in its own secretions. The reaccumulation of pus required reinsertion of the bronchoscope the next day to pump out the secretion. A subsequent radiograph showed the abscess to have disappeared entirely.

DISEASES OF THE PLEURA

By John H. Musser, M.D., and Edward H. Goodman, M.D.

PLEURITIS

In discussing treatment of inflammation of the pleura, a more consecutive consideration of the subject can be made if some classification be followed. Sharp lines cannot be drawn with certainty between the various stages or forms of the disease. The classification which we prefer to regard as suitable for an intelligent discussion of treatment is:

1. Acute fibrinous pleuritis: (*a*) Primary; (*b*) secondary.
2. Acute serofibrinous pleuritis.
3. Chronic fibrinous pleuritis.
4. Chronic serofibrinous pleuritis.
5. Purulent pleuritis (empyema).

Subsequent sections will embrace the treatment of hydrothorax, pneumothorax, and tumors of the pleura.

When instituting treatment in pleuritis, it must be borne in mind that a not too limited or narrow view of the individual case should be taken, that is, that the symptomatic treatment, while of course of utmost importance in giving relief, is yet but a small part of therapeusis. Valuable indications for treatment are derived from our knowledge of the etiology and pathology of the disease, from the symptoms and clinical course, and from those facts in the social and family life and the previous medical history which bear upon the progress of the disease.

Adaptation of the treatment should be made after a study of the defensive efforts of the organism to control the process. Inasmuch as we see in this process an infection, it is likewise seen that the defenses are those which are present in the infections. Hence fever, leukocytosis, and inflammation are found, or the modifications of the serum, as is wont in the infections, are seen (antibodies, opsonins, agglutinins, aggressins, precipitins, cytolysins). The extensive consideration of the treatment of infections by Hektoen in the first volume applies to the treatment of infections of serous membranes.

Knowledge, then, that the disease is an infection affords a basis of action that is most clear. The determination of the nature of infection further clears up the line of procedure. Inasmuch as from 65 to 80 per cent. of all cases are discovered to be tuberculous, again it comes plainly to one that in the larger number of cases of pleuritis the treatment must be that of the treatment of a manifestation of tuberculosis. Moreover, we learn that streptococcic infections demand more active interference than the pneumococcic infections.

As the disease is often secondary, contributing lesions in other parts of the body should be unearthed and reckoned with in the treatment of the infection. Thus antecedent or associated bronchitis, tuberculosis, pneumonia, streptococcic and staphylococcic infection in any part of the organism, typhoid fever, the acute exanthemata, gonorrhea, and syphilis, may each be regarded a causal factor in producing pleuritis, and the management of all these sources of infection must be carefully considered before treatment can be thoroughly carried out.

The whole process of pleurisy, as stated above, must be regarded as a manifestation of the natural defenses possessed by the organism, and the formation of these defenses should be encouraged and the cause of their production removed or made less influential. The first stage in a pleuritic infection is usually that of fibrinous exudation, called out to protect the necrosis of the endothelium caused by the bacterium, the same as a scab forms to protect a wound. Further irritation by the bacterial agent and by the respiratory movements but serves to increase the output of exudate, and based on this knowledge we apply therapeutic measures to combat both—the first by supporting the general system to throw off the infecting bacterium, and the second by putting the part at rest.

Further on in the course of the disease a secondary line of defense is called into action which finds expression in the outpouring of serous fluid, as a result of the vascular dilatation. This fluid is serviceable, since it contains antibodies, serves to dilute the irritant, and acts as a fluid splint. On the other hand, it tends to carry the causative factor from the original focus, affords pabulum for bacteria, and by its presence, if too long continued, is conducive to the formation of adhesions.

Resorption of the fluid may take place spontaneously, and may be rapid or slow. If there has been primarily but a small area of pleural tissue affected, thickening with localized adherence may be seen, and this varies in degree until enormous adhesions involving the entire parietal and visceral pleural surfaces take place (tuberculosis). Very often in the necropsy room pleural adhesions of even an extensive degree are found quite by accident, their presence having been overlooked by the clinician on account of absence of objective and subjective symptoms.

Remembering that the fluid may be regarded, on the one hand, as a safeguard against further advance of the infection, and, on the other, as a menace against the health of the individual, it is not to be wondered at that physicians have arrayed themselves on either side of the question, the one advocating postponement of aspiration, and the other favoring early removal of the fluid.

Treatment based on symptoms alone, without regard to any other fact of the case, is sometimes, as in severe pain, a *sine qua non*. From the urgency of a particular symptom the physician is ofttimes driven to its amelioration, without conception of its cause. From the relief given by the successful application of a therapeutic measure, the physician is too often influenced by the patient's temporary, perhaps more or less permanent, feeling of good health, and ceases to inquire into more intimate causative conditions, and therefore ceases to understand the case in hand. As a starting-place treatment based on symptoms is to be recommended, but as a terminus it has no value. Symptoms which indicate poor reaction should compel treatment to increase resistance; on the other hand, sedative or depletive measures are not amiss if the reaction is excessive.

The treatment of all forms of pleuritis is influenced by the age and sex of the patient, the habits, the occupation, insomuch only as these factors favor or retard the defensive reactions of the organism. While from observation we say the young and the old, the feeble and the robust, the temperate and the intemperate, should have diverse methods of treatment, we know, by our instruments of precision, more precisely the indications for treatment in the special varieties. Our knowledge of the clinical course of the disease under varying circumstances is substantiated and explained by our more precise knowledge from the use of instruments of precision and by experimental studies.

When pleurisy occurs in a patient suffering from chronic heart disease, chronic nephritis, or some chronic infection, again we have to modify the treatment in accordance with the nature and resisting powers of the organism. Finally, the state of the functions of digestion, elimination, and the circulation must be observed. When required, they should receive proper attention. This particularly applies to the eliminative and circulatory powers of the organism, as upon them depend the discharge of toxic products. Most observations are trite, and yet more worthy of repetition in the treatment of diseases of serous membranes than in most affections.

To base the treatment of pleurisy on facts of the social, previous medical, and family histories, or on etiology, morbid processes, or on symptoms alone, were the height of folly, but we insist that all of these things should be inquired into, so that the rationale of treatment may be placed on as sound a basis as possible.

Acute Fibrinous Pleuritis

The first therapeutic indication in this form of pleuritis is the relief of pain, since it is this symptom which drives the patient to the physician. If the case is an ambulant one, marked relief can be obtained by fixing the side with adhesive plaster. This is accomplished by narrow strips of zinc oxid plaster, which are first applied to the paravertebral region and then wrapped about the chest to the sternum, the patient expelling the breath as the plaster is applied to the skin. Additional straps are used in the same manner until the painful area has been covered from below upward and the excursions of the chest on the side well limited. The plaster should not be allowed to remain on for more than a week, when it is readily removed, if, the night previous, vaselin has been well rubbed in.

When feasible, rest in bed, in addition to rest of the inflamed part, is of great benefit, and fixation of the side by means of a bandage is to be preferred because of its easy removal for purposes of examination. Sometimes the pain persists in spite of fixation of the chest, and in these cases diaphragmatic involvement is to be borne in mind. Here a hot-water bottle or an ice-bag may be used to advantage, as may also poultices of linseed or mustard or a turpentine fomentation. In extreme cases hypodermatic injections of morphin must be given.

There is generally more or less fever associated with pleuritis, which is hardly ever of such degree that measures to combat it are indicated. Free catharsis should be obtained by calomel and saline purges.

Remembering that pleurisy is often a manifestation of disease in some other part of the body, the recognition of the source of the infection should be the aim of the physician. If part of a tuberculous condition, treatment should not cease with amelioration of symptoms, but when the first discomfort is over, and even during convalescence, hygienic treatment should be begun. (See section on tuberculosis.) If part of a pneumococcic infection, treatment should be directed to the primary condition, the pleuritic involvement being treated expectantly, by warmth or cold, or in extreme cases by morphin. Caution should be observed in the use of the latter in the presence of kidney disease, although we feel that the dangers of its use in such conditions are greatly exaggerated. A healthy normal individual may be given $\frac{1}{4}$ grain of morphin combined with $\frac{1}{150}$ grain of atropin hypodermatically, although to a neurotic patient, where all symptoms are unduly emphasized, perhaps as good results may be obtained from $\frac{1}{24}$ to $\frac{1}{16}$ grain.

Should the pleuritic involvement be but an expression of a rheumatic affection, great benefit is to be expected from the use of salicylates—aspirin, salophen, sodium salicylate, etc. We recommend large doses of the salicylates, frequently repeated until the constitutional effect is reached, then decreasing. Very good results have been obtained, in ward cases seen in the Presbyterian Hospital, Philadelphia, by the administration of sodium salicylate, gr. xv, repeated every three hours until buzzing and ringing in the ears were complained of. It was quite striking—the complete absence of any gastric symptoms under this régime.

The association of pleurisy with syphilis has led Stintzing, in obstinate cases, to put the patient on anti-syphilitic treatment, and he especially recommends the use of iodids, claiming to have seen cures under their use.

After subsidence of the acute symptoms, respiratory exercises are to be undertaken. These will be spoken of, however, when the treatment of chronic fibrinous pleuritis is discussed.

ACUTE SEROFIBRINOUS PLEURITIS

During the acute attack rest in bed is absolutely demanded, and should be strictly insisted upon, and at first, treatment should be directed toward diminishing the severity of the symptoms. Measures spoken of under the preceding heading may be used, although strapping of the chest is of doubtful value, since it embarrasses still more the respirations which are interfered with by pressure of the fluid. If the effusion is small, extending not more than a hand's breadth beyond the lower limit of the lung anteriorly, laterally, and posteriorly, rest and general hygiene are indicated.

Remembering that for purposes of treatment it is well to consider every case tuberculous, treatment should be based especially on the etiologic factor. After subsidence of fever, rest in bed is not so imperative, although with the greater liberty afforded the patient, attention to the temperature should not be neglected. A well-ventilated sleeping apartment at night, a cheery room, and bright, dry, sunny surroundings by day are all essentials. Should the fluid become stationary, and should it give rise to no pressure symptoms, the management of the individual case is that of a tuberculous patient, as far as eating, resting, exercise, and general hygiene are concerned.

Absorption of the fluid does sometimes occur, and when not causing untoward pressure symptoms, nature may be assisted to a certain extent. The method of dry diet may be tried, and although good results are more likely to be obtained in a simple hydrothorax, we have met with variable degrees of success in its employment. The so-called saline method may be employed, whereby free purgation is induced by large doses of magnesium sulphate in the morning. The details of this so-called Hay treatment are given by Osler as follows: "If there is no fever, a meat diet, with an egg and dry bread and 8 to 10 ounces of liquid in the form of milk or water, should be given. Every morning if the patient is robust, otherwise every second morning, from half an ounce to an ounce of Epsom salts is given an hour before breakfast, in as concentrated a form as possible."

Salicylates have a warm advocate in Dock, who believes good results have followed the administration of 15 grains of sodium salicylate four times a day. Potassium iodid, preferably in ascending doses, has some champions, but our experience has not been very satisfactory. Painting of the affected side with iodin is not frequently done, and likewise has the use of blisters fallen into disfavor. Free diuresis and the protracted use of a salt-poor diet have been reported on favorably by some clinicians.

Autoserotherapy has in recent years commanded some attention, although the opinions vary as to its actual value. This method of treatment, first suggested by Gilbert in 1907, consists in reinjecting under the skin 2 c.c. of the fluid aspirated from the pleura. The fluid is withdrawn by means of a horse hypodermic syringe, and then, without removing the needle, injection of the fluid is made under the skin through the original puncture wound. But one injection usually suffices, although should the effusion show no signs of diminution, it may be repeated. No injurious effect has been experienced with this treatment. In tuberculous pleuritis a slight rise of temperature has followed. The general belief is that the fluid is beneficial on account of the antibodies it contains.

When, despite all we can do from a medicinal standpoint, the fluid mounts up, and the chest becomes one or two thirds full, other measures must be resorted to, as spontaneous absorption is now out of the question. Most physicians are agreed that when the effusion becomes so large that pressure symptoms are apparent, such as dyspnea, cyanosis, or impaired cardiac function, or where there is displacement of organs, even without any evidences of pressure, or when the effusion shows no sign of absorption after a week or ten days of medicinal treatment, then the question of mechanical removal of the fluid should be considered (thoracentesis). We are speaking here of the cases of clear fluid, since these are the only ones which should be treated by thoracentesis. When the fluid becomes turbid, the chances are that thoracentesis alone will be ineffectual, since empyema may develop. In these cases and in cases of true purulent pleuritis the assistance of a surgeon must be had, as a more radical procedure will have to be done.

Thoracentesis.—*Indications for:* (1) Large serofibrinous effusions; (2) effusions associated with pressure symptoms; (3) double effusions.

There should be no discussion concerning these three indications, as remarked above. The point which still remains mooted is whether small or medium effusions should be tapped. Stintzing recommends paracentesis when the effusion passes the fourth rib anteriorly and the middle of the scapula posteriorly, and remarks, "It is better to puncture three times too early than once too late." Though general rules cannot be formulated, we feel that if, after a week or ten days on medicinal treatment, there is no diminution of the fluid, then recourse should be had to paracentesis. If delayed longer, the danger of adhesion formation increases, and also the likelihood of reaccumulation of the fluid. As Lord says, early removal does not prevent reaccumulation, but it makes the condition less common.

Site of Puncture.—This will vary, of course, with the amount of the effusion; but if the latter be of large or medium amount, and not encapsulated, the customary site of puncture is in the fifth or sixth intercostal space, midaxillary line; or if the effusion be small, then in the seventh space, between the scapular and posterior axillary lines. If the effusion be encapsulated, it must be carefully mapped out and the site of puncture based on anatomic considerations.

Another part of the chest often selected is just below the angle of the scapula, but the lung is sometimes adherent to the chest-wall at this point, and therefore the danger of causing pneumothorax is increased.

Sterilization of Skin.—Since the introduction of skin sterilization by iodin the technic has been much simplified. All that is necessary is to paint the skin repeatedly with a 3 per cent. solution of iodin, after washing with soap and water, which very efficiently sterilizes the part.

Instruments Used.—A silver trocar and canula at least 7 cm. long and about 1.5 to 2 mm. in diameter should be employed, although various sizes should be at hand. The canula is provided with a lateral outlet, fitted with a stop-cock, and at the proximal end another stop-cock, which may be closed when the trocar is removed. The best apparatus to use is that of Potain, which consists of a graduated bottle sufficiently large to accommodate 1500 to 2000 c.c. of fluid, and of such a quality that it may be sterilized without breaking. In the neck of this bottle is fitted a rubber stopper with one opening, into which a T-shaped metal piece is put. To one arm of the latter, the lateral outlet of the canula is connected by means of rubber tubing, and to the other a hand-pump by means of tubing. A manometer may be connected with the bottle, whereby the negative pressure can be estimated.

Precautions.—The instrument should be carefully tested before aspiration is begun, and sterile water or salt solution may be used for this purpose. Pneumothorax may result from imperfectly adjusted tubing and poorly fitted parts of the instrument, and the caution to see that everything is in perfect working order is not based on fancy. When aspiration is being carried on, the negative pressure in the bottle should be just sufficient to permit of an uninterrupted flow of the effusion, and it seems hardly necessary to state that during paracentesis the air in the bottle should always be under negative pressure.

Technic.—In these days of asepsis it may seem superfluous to say that all instruments used in connection with paracentesis thoracis should be sterilized just before use, and that the operator's hands should be surgically clean. The patient may sit upon an ordinary chair, although a semi-recumbent position in bed is to be desired, since the patient requires no exertion following the operation. A hypodermic injection of eucain (2 per cent.) renders the operation comparatively painless, or the part may be anesthetized with ethyl chlorid spray. Before puncture is made, the air should be partially exhausted in the bottle and the stop-cocks closed. The upper margin of the rib should be carefully recognized and the needle thrust inward and slightly upward, the point of the needle entering above the upper margin of the rib. It is pushed in until there is no further resistance. The lateral arm is then connected with the aspirating bottle, the trocar withdrawn, and the proximal stop-cock closed, and then all valves opening into the aspirating flask opened, when the fluid should begin to flow. During aspiration negative pressure is maintained in the bottle, of just enough force to permit of a continuous flow of the effusion.

When ready to withdraw the canula, a piece of gauze is held against the place of puncture, the canula withdrawn quickly, and the puncture covered with gauze-collodion dressing. The patient should remain in bed for a few hours following the operation.

Sometimes it happens that even with powerful suction no fluid can be withdrawn, and the trouble may be that a particle of lymph blocks the orifice of the canula. Mosny and Stern have called attention to the cases of inoperable effusion which they have called *pleurisie bloquée*, or blocked pleurisy. Such a condition may be explained by a lung rendered incapable of expansion on account of adhesions or by obstruction to the air-tube. The treatment is to introduce two needles, one of which is the means of injecting oxygen or nitrogen or sterilized air. Ewart advises a needle with a Y-shaped connection, which dispenses with a double puncture.

Complications of Paracentesis.—Although paracentesis thoracis is in itself a comparatively simple procedure, yet there have been a sufficient number of fatalities and of serious consequences following removal of the effusion to warrant a word of caution, in order that an opinion of the innocuousness of the procedure should not become general.

If paracentesis has progressed favorably and uneventfully, the patient should be kept at rest after its completion, in order to avoid the dangers of embolism. Occasionally there are cases accompanied by severe hemorrhage from the intercostal artery, and this may be avoided by making the puncture along the upper margin of the rib, since the artery normally traverses the lower margin. However, an anomalous position of the artery may render futile this precaution. Such an event is rarely seen, and we have never been the unfortunate witnesses of a hemorrhage from the intercostal artery.

In very rare instances sudden death has occurred during the operation, for which at autopsy no morbid process has been found which could be regarded as an etiologic factor. Varying degrees of shock have been encountered, and the suggestion of Capps and Lewis, that irritation of an inflamed pleura may excite vaso-dilatation or cardiac inhibition, with resulting fall of blood-pressure, is worthy of much consideration. Lord well says that these facts should make one fearful of any unnecessary play of even a blunt-pointed canula against the pleura. The intravenous injection of adrenalin is an efficient means of controlling this.

A very real complication lies in the production of an albuminous expectoration at the termination of paracentesis. By many it has been regarded as a sudden transudation of blood-plasma from the pulmonary vessels, pulmonary edema, and lately it has been held to be the result of the pleural effusion entering the alveoli of the lungs. This is possible only when there has been severe coughing. Gerhardt emphasizes the importance of interrupting thoracentesis when the patient begins to cough, even if the cough can be momentarily controlled. Lommel believes the administration of morphin is indicated in every case of pleural puncture as a means of controlling the tendency to coughing. Pneumothorax is considered by Ewart to be by no means an uncommon event, while embolism of distant arteries by coagula from the pulmonary veins may take place, and hemiplegia result.

Amount of Fluid to be Withdrawn.—This depends on the amount of effusion present, but as much as possible should be removed without causing any serious discomfort to the patient. Death has occurred when large amounts have been withdrawn, and the same has been encountered when but small amounts have been aspirated. It is rarely safe to exceed two liters, and when such an amount has been reached, it is well to discontinue. The remaining fluid is apt to be absorbed. The older the condition, the less fluid can be removed with safety, for multiple adhesions materially increase the danger.

As has been said before, thoracentesis should be stopped as soon as the patient begins to cough immoderately, or commences to get dyspneic, or shows any sign of cardiac discomfort.

Chronic Fibrinous Pleuritis

This form of pleuritis is, as we have already learned, generally due to tuberculosis, and treatment of the condition should be that of the cause (see Tuberculosis). In addition to general measures, however, much may be gained by systematic respiratory exercise. Rosenthal* recommends such procedures even during the acute stage, and says he has never seen bad effects from their use. When the condition is supposedly cured, he believes these measures, together with general hygiene, have been responsible for the prevention of tuberculosis in many instances.

During the acute stages he recommends ten deep respirations through the nose, the patient lying on his back with his arms by his side. These are gradually increased until he is able to perform the following in one sitting: Twenty respirations (nasal) lying on the back with the arms by his side; twenty respirations using the diaphragm; twenty respirations with arm of the healthy side behind the head. The diaphragmatic breathing is so performed that the patient must raise the hand of the physician, placed without pressure on the subject's abdomen.

As conditions improve, the following may be accomplished at one séance: Twenty nasal and twenty diaphragmatic respirations; ten respirations with flexion of the right leg and ten with flexion of the left. During these, the arm of the affected side is first held across the thorax and later held at the side of the body.

Very rapidly a sequence of five exercises, repeated twenty times, may be arrived at, consisting of, at the termination of fever, twenty nasal and twenty diaphragmatic respirations, the arms by the side; twenty respirations with flexion of the right leg and twenty with flexion of the left; and, finally, twenty respirations with the arm of the well side behind the head.

Gradually as convalescence progresses the patient should breathe with both arms behind the head; then with the arm of the affected side behind the head, accompanied by oscillation or movement of the arm of the healthy side. With this unilateral movement, alternate movements are prescribed, and bilateral movements are only given late in the disease.

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*Rosenthal: Arch. gén. de méd., 1909, 200, p. 1.

Of course, in having the patient perform these rather strenuous movements constant regard must be paid to the pulmonary condition if one be present, and under no circumstances should the patient push these exercises to the point of fatigue.

Inhalations of air by the pneumatic cabinet are advantageous, and it should be borne in mind that any measures bringing about expansion of the lungs are more successful in children than in adults.

The treatment of pleural thickenings and adhesions by means of fibrolysin (thiosinamin + sodium salicylate) has been recommended, using 2.3 c.c. of Merck's preparation (containing 0.2 gram thiosinamin) intramuscularly (locally) or into the gluteal muscles, two or three times a week, depending on the severity of the case. The site of injection makes no difference in the effect of the drug, since action takes place through the circulation. Injections are said to be painless, and but insignificant symptoms occasionally follow, such as slight fever, moderate languor, and headache. In early cases results are striking, but in later cases injections do not promise so much. Schütgen recommends that injections be given immediately after the more or less complete absorption of the exudate.

CHRONIC SEROFIBRINOUS PLEURITIS

Sometimes it does happen that after withdrawal of the fluid from the chest its reaccumulation cannot be prevented. Murphy has suggested that in these cases the fluid be aspirated, and two or three ounces of a 2 per cent. solution of formalin and petrolatum, prepared twenty-four hours before, be injected,—a procedure which we can recommend from practical experience.

PURULENT PLEURITIS; EMPYEMA

When pus is present in the pleural cavity, the case ceases to be a medical one, and a surgeon should assume charge. For treatment of this condition see Surgical Treatment of Diseases of the Pleura, p. 243.

HYDROTHORAX

This being secondary to some other condition, the treatment should be based on the etiologic factor. If the hydrothorax is of such a degree that it meets one of the indications for thoracentesis (see above), then puncture or removal of the fluid should be practised.

THE SURGERY OF INFECTIOUS DISEASES OF THE LUNG AND PLEURA

By Samuel Robinson, M.D.

Thoracic diseases invariably come first under the observation of the practitioner of internal medicine. Pneumonia, pleurisy, bronchitis, and incipient tuberculosis are undoubtedly solely within his jurisdiction. Abscess of the lung is occasionally cured by expectant treatment with medication. The internist will readily admit, however, that in the treatment of gangrene, advanced abscess, empyema, bronchiectasis, phthisis, and actinomycosis he is limited to the field of symptomatic relief. Though recognizing that the infections in this group are incurable by medication alone, the practitioner must be convinced of the chances of at least partial relief by surgical interference before he is willing to submit his patient to operation.

It is not until a balance has been reached between the internist's conservative lack of faith and the surgeon's sometimes dangerous leaning to experimental surgery that progress occurs in the treatment of conditions which are acknowledged to be beyond cure by medication alone.

When a balance has been accepted, neglect of early transfer by the internist, or poor operative technic by the surgeon, are alike open to criticism.

The object of this section is to set forth impartially the surgical possibilities in the treatment of these diseases.

SUPPURATIVE DISEASES

Suppurative diseases of the lung and pleura do not contribute materially to the general mortality. Though in one sense a blessing, it may be argued that from a therapeutic standpoint it were better that death were more often the alternative to the early recognition and prompt attack in intrathoracic suppuration. Recognizing the comparatively high tolerance of the lung and pleura to certain infections, internists are too often lax in diagnosis and localization, surgeons too remiss in securing prompt, thorough, and persistent drainage.

Complete recovery, and not the mere saving of life, should be from the outset the main object in the treatment of thoracic suppuration. Although nature strongly combats these infections in spite of our incomplete efforts, accuracy of diagnosis, prompt decision as to the indication for operation, and diligent after-treatment are imperative, not alone to save the patient, but to shorten the convalescence, to prevent amyloid disease of other organs, and to restore as far as possible the normal function of lung and pleura.

Were we possessed of like concern and respect for thoracic as for abdominal inflammation, death would rarely occur; the lung function would be less often sacrificed, and that serious but invariably avoidable condition of chronic empyema might never exist.

The period of delay which is so often allowed to intervene between the probable onset of thoracic suppuration and the moment of operative intervention is appalling as one reviews the medical and surgical histories of hospital clinics. To attribute this loss of time to neglect or ignorance on the part of the practitioner is probably often justifiable, although it is not easy to explain the exact reason for the delay.

Thoracentesis.—It is to be regretted, perhaps, that the diagnostician is ordinarily not entirely satisfied of the presence of pus within the chest until he has seen it. A rise in temperature, with leukocytosis and perhaps a chill, together with other symptoms of suppuration varying in frequency, point with almost a certainty to an undrained purulent process; and yet the internist, though assured of its presence, is rarely prompted to surgical consultation until he has localized the material with an aspirating needle. Reluctance to subject the patient to exploratory needle puncture causes the less progressive practitioner to delay for days or weeks, in the vague hope that the symptoms may be due to other causes and may spontaneously disappear. Failing in this expectation, and forced to thoracentesis, he may be delayed by the want of a suitable needle with suction appliances. The first aspiration may be negative, the patient may have been hurt in the process, and sympathy forces another delay. The second thoracentesis may also fail, and not uncommonly persuades the practitioner that his diagnosis of suppuration was mistaken. Further loss of time ensues, till the gravity of the symptoms and the increasing weakness of the patient induce as a last resort surgical consultation. Here, furthermore, the surgeon may contribute to the delay by his lack of courage to explore the thorax when the internist has failed to localize the process. Surgeons have frequently in such instances advised further delay and further aspirations, until the patient eventually comes to operation with low resistance and thoroughly septic.

If the internist suspects abdominal suppuration in a given patient, he is satisfied with suspicion, and promptly requests operative interference without waiting to be satisfied of the precise localization. He does so realizing that delay may result in the loss of the patient. Why should his attitude be otherwise regarding thoracic suppuration? The presence of tenderness and spasm, which are of such great diagnostic value in the abdomen, is, to be sure, lacking in the thorax; but few practitioners would deny their ability to diagnose thoracic suppuration despite the loss of these contributory symptoms; and, furthermore, even without the confirmative evidence of a positive exploratory needle puncture.

The responsibility of localizing pus within the lung or pleura should be shared with the surgeon; and it cannot be denied that the prevailing loss of time in these cases would be markedly diminished should the internist cease to regard it as his duty to obtain a positive thoracentesis before submitting the case for operation.

Anesthetic Thoracentesis.—Diagnosis by thoracentesis is generally executed by the *stabbing* method. There are several important reasons why this somewhat crude procedure should be supplanted by the slow introduction of an aspirating needle through a channel previously anesthetized. After freezing the skin with ethyl chlorid, a 0.5 per cent. solution of cocain is injected to cover an area of 0.5 cm. The skin may then be pierced with a scalpel. The hypodermic needle is slowly inserted perpendicularly, the solution being forced ahead of the needle as it passes through the layers of the chest-wall. In the resulting absence of sensitiveness the upper border of the rib below can be carefully made out, and more of the solution forced through the intercostal muscles against the sensitive pleura, which absorbs the cocain slowly from the adjacent tissues. Puncture of the pleura then causes no pain. If the hypodermic needle is not used for aspiration, a larger needle can be inserted through the same channel with no discomfort.

The advantages of this anesthetic thoracentesis are as follows: (1) The procedure is free from pain or discomfort. (2) Contact with the rib is avoided because of the slow introduction of the needle. (3) The upper border of the rib below can better be made out and injury to the intercostal vessels definitely avoided. (4) It is doubtful if so-called pleural eclampsia or a sudden reflex collapse resulting in heart inhibition can occur when the pleura has been partially anesthetized from the structures above previous to its puncture. (5) The slow introduction of the aspirating needle frequently enables one to determine by feel when the parietal pleura is passed. Injury to lung tissue, dangers of hemorrhage, and air-embolism are thus reduced. (6) In case of one negative aspiration the patient does not fear subsequent ones, and the physician is less loth to continue his explorations.

Anesthetic thoracentesis, whether performed by the internist or by the surgeon, is by far the preferable procedure, and its adoption should become more general.

ABSCESS OF THE LUNG

Acute abscess of the lung is generally of metapneumonic origin. In the resolution of a pneumonic process either empyema or abscess may occur. The differentiation between the two is sometimes difficult, especially if a purulent pleurisy is limited by adhesions and presents localized physical signs. The onset of sputum is generally the best means of differentiation.

Septic processes in the mouth, pharynx, and neck are also causes of acute pulmonary abscess, especially after operations in these regions. Abscess not infrequently follows tonsillectomy and the extraction of teeth. These infections may occur by direct inhalation or by lymphatic extension. Postpartum sepsis is occasionally an etiologic factor. Given any one of the above exciting causes, the onset of symptoms suggesting concealed suppuration should lead one to suspect acute abscesses of the lung.

Abscess of the lung is rarely diagnosed previous to the onset of sputum. Without considering the bacteriology of sputum at length, suffice it to say that its character is dependent largely upon the completeness of the bronchial drainage. If the bronchial opening to the abscess cavity or cavities is large enough to drain them by expectoration, the sputum is less fetid and the variety of bacteria is limited. If, on the contrary, the drainage is intermittently insufficient, the retained sputum when evacuated has a characteristic odor and presents a large number of pus organisms, usually with a predominance of pneumococci. Much time may be unnecessarily spent in the search for elastic fibers and hematoidin crystals. The etiologic factors, the general character of the sputum, and the contributing local physical signs should be sufficient for diagnosis.

Acute abscess of the lung is generally peripheral, and not infrequently in the region of the inferior angle of the scapula. The signs are by no means pathognomonic. They vary according to the proximity of the foci to the chest-wall, to the amount of secretion remaining undrained in the existing cavities, and to the extent of interstitial pneumonitis surrounding these cavities. The percussion note and auscultatory findings may change even from day to day, depending upon the above factors.

Thoracentesis not infrequently fails to produce pus because the abscess cavity is smaller than the area of dullness for which the surrounding pneumonitis is responsible. A negative needle puncture in the presence of these peripheral signs should never be regarded as a contraindication for operation, and good surgical technic does not require a positive needle wound as a guide to the operation.

It cannot be denied that the spontaneous drainage and healing of pulmonary abscess is of frequent occurrence. The tendency of internists, however, is to prolong the hope of bronchial evacuation beyond that point at which surgical drainage is attended with the best results. When a period of expectoration of foul pus is intermittently followed by a period of retention, with unmistakable evidences of toxic absorption, surgical intervention should be promptly resorted to. If delayed, the resistance of the patient is constantly diminished until the operative risk is increased. Furthermore, in delayed cases the bronchial fistula necessarily established at operation is larger and less liable to subsequent spontaneous closure, because of the chronic pneumonic condition surrounding the abscess, which tends to prevent its collapse.

A further danger in over-enthusiastic expectant treatment is that of the rupture of the abscess either into an interlobar fissure or into the general pleural cavity. The mortality of operations for empyema secondary to a ruptured abscess is high and its occurrence is inexcusable. The drainage of simple abscess, on the contrary, is a simple procedure, and in the cases operated promptly is attended with marked success.

Surgical Treatment.—If thoracentesis has been positive, a simple operative technic may be employed, as in acute empyema. An inch of rib is excised and the needle channel enlarged until a finger is admitted into the abscess cavity.

If all cases of acute pulmonary abscess were left unoperated except when such a technic is possible, fatalities would unnecessarily occur.

In the absence of positive needle puncture the excision of one rib with finger exploration is bad technic. That area of the pleura corresponding to the abnormal physical signs should be laid bare. A curved incision should be made outlining a semicircular skin and muscle flap which when reflected upward will expose three ribs for a distance of 2½ to 3 inches. The ribs exposed are subperiosteally resected, the intercostal bundles between the resected ribs are ligated opposite the rib ends, and the intercostal tissue and vessels are removed. To expose the pleura the following technic should be employed. The posterior periosteum of that rib nearest the center of the suspected area is incised carefully for 2 cm. The forefinger introduced into this incision will establish an area of cleavage by which a square flap can be lifted from the pleura and cut away, carrying with it the posterior periosteum of all the ribs resected, together with the connective tissue between them. In this manner an area of pleura is exposed corresponding to the outer limits of the ribs resected. This area of cleavage does not exist except in the presence of pleural inflammation and thickening, and the dissecting finger will meet obstruction at the edge of the field where the normal pleura begins; in other words, where adhesions are not present. Through this exposed field the operator has an admirable opportunity to explore with a needle or blunt instrument for underlying pus. Punctiform yellowish caseous areas often serve as a lead to the underlying abscess. If pus does not escape when one of these areas has been perforated, the little finger is introduced, which follows the necrotic area until the abscess cavity is reached. The bleeding is slight, and the amount of pus expressed is usually small in quantity, but of the same fetid odor and bacteriologic constituents as the sputum. The cavity should be packed with gauze, which is allowed to remain for three days. The skin flap is restored and sutured in layers, but not until a circular portion of the flap has been excised of sufficient diameter to exceed the size of the abscess cavity. Precaution in this regard will provide during the whole convalescence a conical-shaped wound with the base external and the bronchial fistula at the apex.

Although post-pneumonic abscesses are generally near the periphery, those associated with the inhalation of foreign septic material are often more central. The operative technic in such cases is more complicated. One cannot rely on the extra-pleural technic described above. It is necessary to open a normal pleural cavity, palpating the suspected lobe, and to protect the normal pleura before traversing the lung and establishing drainage.

Such an operation is undoubtedly facilitated by the use of differential pressure. The operative pneumothorax which invariably occurs ceases to be a source of anxiety, the lung tissue can be better palpated in the inflated condition, and the subsequent suturing of the lung to the edges of the thoracotomy wound is likewise aided by the approximation of the lung to the chest-wall which results from artificial expansion. It has long been regarded as essential to perform this operation in two stages, permitting an interval in which nature may more completely wall off and protect the normal pleural cavity. This double procedure is now regarded as less essential in view of the improved technic of suturing the lung under inflation. The finger is undoubtedly the best instrument with which to traverse the normal lung tissue in search of a deep-seated abscess. A cautery may also be of value, but the use of metal instruments is more likely to be attended with hemorrhage.

The promptness with which patients respond to the operative drainage of pulmonary abscess is most gratifying. The sputum quantity is immediately diminished, and gradually disappears after the first removal of the packing. All the symptoms of septic absorption rapidly disappear, the patient is out of bed within a week, and a rapid gain in weight is of invariable occurrence. A contrast of this picture to that of a patient rapidly losing ground in the course of expectant treatment in which the bronchial drainage is entirely insufficient, is convincing enough to justify a more prompt interference in this group of cases.

GANGRENE

For many reasons abscess and gangrene should be classified together, as suggested by German writers. The etiology and pathology are not the same, the difference consisting largely in greater destruction of lung tissue in the presence of a true gangrenous process. The finding of sequestra in the sputum commonly leads to this differentiation in diagnosis, although the latter should undoubtedly be made long before its appearance. The appearance of blood in the sputum is characteristic of gangrene rather than of abscess, and death from hemorrhage is the usual sequel in neglected cases.

Gangrenous cavities are less often peripheral, but when so situated are amenable to the plastic treatment which has been suggested, by which the skin and muscle flap are utilized and sutured to the base of the cavity after its operative evacuation. This method is by no means always applicable, but should be borne in mind as a means of closing bronchial openings and arresting hemorrhage.

BRONCHIECTASIS

Differential diagnosis is important because the treatment is quite contrary to that of acute abscess of the lung, with which bronchiectasis is often confounded. The diagnosis can best be made from the history and from sputum examination. There is a chronic cough, with frequent recurrence during the winter season of "grippe colds," sometimes resembling bronchopneumonia, and a profuse grayish-green sputum, pungent but seldom fetid, in which the influenza bacillus is the predominating organism. The use of *x*-ray is frequently of no value in differentiating bronchiectasis from allied conditions. The physical examination is perplexing and may be misleading. A diseased lung may present a complexity of signs which, in the absence of history and sputum examination, are almost beyond interpretation. The bronchial openings of abscess cavities produce sounds which vary according to the amount of residual secretion in the cavities. Vesicular breathing may be heard, and a variety of râles, then missed. Dullness may change materially in a few hours, depending upon the contents and depths of the cavities. The internist controls the hygiene, administers a limited number of drugs, and advises climatic changes and protection from new infection, teaching the patient methods of emptying his cavities at longer intervals and not continuously. The Germans aid the patient in sputum evacuation by the use of a rapidly revolving disk upon which the patient stands, bending at the waist. It is claimed that a thorough expulsion of sputum is provided by the centrifugal force employed.

Is surgical intervention indicated? First, determine whether the bronchiectatic process is diffuse in the lung or is confined to a lobe. Physical examination and the *x*-ray are both useful for this purpose. If diffuse, avoid surgery. If confined to one lobe, hesitate. An abscess cavity of considerable size may be suspected near the periphery. The amphoric breathing which led to its detection is real evidence that drainage is already established by the bronchus. Should this cavity be drained by operation? No; because there may be several more cavities in the neighborhood which are not reached. The patient is provided with a discharging sinus and bronchial fistula which add more to his distress than to his relief. The one possible license for a drainage operation in bronchiectasis is in those rare cases in which the bronchial drainage of a cavity has been blocked, a secondary infection has developed, and the patient is steadily losing ground from septic absorption. Drainage in such cases is not a cure, but may prevent toxemia.

Another form of treatment is recommended, consisting in a resection of all ribs overlying the diseased lobe. Collapse of the lobe and consequently of the contained bronchiectatic cavities occurs. This immobilization operation has been successful in some 50 per cent. of phthisical patients operated by Friedrich. In bronchiectasis it is more dangerous because of the extensive quantity of sputum. The bronchial drainage of this sputum should not be interrupted or allowed to enter the sound lung. The procedure is too extensive to undertake with local anesthesia, with which the coughing reflexes may be preserved. During the rib-resection under deep anesthesia, inhalation of sputum to the opposite bronchus is a danger. The risk of direct or embolic extension of infection is greatest after operation, when the collapse of cavities results in an added necessity for coughing and raising. Coughing often causes excruciating pain in the large operative wound. Furthermore, at forced expiration the lax chest-wall bulges and the counterpressure necessary for expulsion of sputum is lost. The application of a pad and swathe to support the chest-wall increases the pain of coughing. The patient soon abandons the attempt, sputum becomes stagnant, and infectious material may take any course but the one desired. This operation is not to be recommended in bronchiectasis.

There remain therefore two possibilities in the operative treatment of bronchiectasis: artificial pneumothorax by nitrogen injection, or excision of the diseased lobe.

This artificial pneumothorax treatment, referred to below, is included as an operative treatment for the reason that the first injection may be preceded by an incision to the parietal pleura for the inspection of the latter. If adhesions are present, a new area should be explored or the treatment abandoned. The only fatalities from the pneumothorax treatment have resulted from the direct puncture of the adherent lung not previously explored by incision.

In bronchiectasis the object is identical with that of rib-resection, namely, to collapse cavities and to reduce their cubic contents. It differs from it, however, in that the expectoration is constantly under control during both the local anesthesia operation and the convalescence. The continuity of the chest-wall is not disturbed and coughing is not painful.

This treatment offers the patient better chances of relief than any form of medication or expectant treatment.

Complete excision of a bronchiectatic lobe is the operation which, theoretically at least, best meets the requirements. The whole process is at once removed. This may become an established treatment of lobar bronchiectasis. Much has recently been learned regarding the technic of lung excision, and the prospects of success are greater than they were six years ago. The obstacles present in such operations on the human being, namely, sputum and adhesions, have not yet been artificially produced in animals, and future progress will depend largely upon experience in human patients. In the interim, between the beginning of anesthesia and the ligation of the main bronchus, the accumulation and aspiration of sputum are a danger. The separation of adhesions from the adjoining lobe, pericardium, or diaphragm may result in lacerations which add to the complications. This is one of the instances in which differential pressure is of value in the presence of suppuration. The accumulated sputum is more inclined to remain distal in the bronchi, from the resistance to its exit afforded by pressure. Wide-open pneumothorax, which is essential for free access to the root of the lung, is devoid of danger with the use of apparatus.

The solution of the present difficulties rests in the maintenance of coughing reflexes by the use of local anesthesia up to the point of ligating the bronchus. The severity of the operation is diminished by employing two stages, the first consisting in ligation and freeing of adhesions, the second in amputation and removal of ribs to aid in the obliteration of the emptied portion of the pleural cavity. Garrè has removed a bronchiectatic lower lobe in an operation of two stages. Five other successful removals of a lobe of the lung are now on record.

This is the limited encouragement in the surgical aspects of bronchiectasis. Meanwhile the internist should have faith. In selected lobar cases he should have surgical consultation, if possible, with one who is accustomed to thoracic surgery. Recovery without operation is hopeless; with excision there is a reasonable chance which will increase with added experience in human beings.

LOCALIZED OR ENCAPSULATED EMPYEMA

This term is commonly applied to the accumulations of pus which sometimes occur either between the two visceral layers of the pleura, as in an interlobar fissure, or between the visceral and parietal pleuræ, where the general infection of the pleura has been prevented by protective adhesions and the pus is incarcerated. While such forms of empyema unquestionably exist, their frequency is perhaps exaggerated by the mistaking of a peripheral lung abscess for an encapsulated empyema. The etiology and symptomatology of both are not unlike. Drainage is the indicated treatment of both. The differential diagnosis may usually be made by the usual absence of sputum in empyema. This differentiation is inadequate, however, if the abscess has not yet connected with a bronchus. Operative drainage discloses the identity of both, but it is probable that surgeons do not always note the factors which make the distinction, and record cases of abscess as though they were empyema. Opening and drainage of an abscess cavity should be attended by a bubbling of air through the bronchus and by occurrence of hemorrhage, from trauma to the necrotic lung parenchyma. These factors, though invariably present in an operation for abscess, rarely exist in the drainage of an encapsulated empyema. The pus accumulation in peripheral abscess is within the lung tissue; the pleural layers are adherent and are incised together. In localized empyema, on the contrary, the pus is between the visceral and parietal pleuræ. Death is rarely a sequel to either of these lesions, and consequently autopsy evidence is lacking. But it is reasonable to suppose that the so-called rupture of empyema into a bronchus does not occur without a previously existing peripheral abscess cavity which primarily or secondarily occurs adjacent to the empyema. It would seem that the bronchus sufficiently large to permit the sudden evacuation of a considerable amount of pus must be some distance from the periphery of the lung, and that although an empyema and abscess cavity may previously connect, a sudden evacuation certainly occurs through the bronchus which ruptures from the abscess cavity.

EMPYEMA

At the beginning of this section the necessity of early recognition of thoracic suppuration was emphasized. If in the convalescence following the crisis of pneumonia a rise in temperature, increased leukocytosis, a chill or night-sweat, vomiting, abdominal pain, or other latent symptoms occur, the presence of empyema should at once be suspected. Infections of the pleura by blood metastasis are sometimes seen in scarlet fever, measles, typhoid and whooping-cough, and other systemic infection. A careful chest examination should be made when the progress of these diseases is accompanied by signs of additional septic absorption. Trauma and local disease of the chest-wall as causes of empyema are less often overlooked, because of the direct association of the pleura with such conditions. Infection of a pleuritic effusion by needle puncture is of extremely rare occurrence, and should not be considered as among the probable causes of empyema. The fact that the first needle puncture withdraws a sterile fluid, and a later puncture pus, ordinarily indicates that the fluid has, for other reasons, in the meanwhile become purulent. When the withdrawn fluid of a primary puncture contains bacteria, the approach of empyema may be suspected. Martin even recommends the aspiration of such non-purulent infected effusions to anticipate the added difficulties of a subsequent empyema. Griffiths, on the contrary, found but two of one hundred and fifty-one cases of aspiration in which the fluid became purulent, one of which was complicated with tuberculosis and the other with erysipelas.

Flatness in place of dullness, absence of râles, and absent or much diminished respiratory sounds should aid in differentiating a pyothorax from an area of consolidation. Localized tenderness to pressure on the thoracic wall (Musser) will often aid in diagnosis.

In all cases of purulent pleurisy the aspirating needle should be utilized to verify the diagnosis, but failure to express pus should by no means serve as a contraindication for operative exploration. While negative thoracentesis is not uncommon in cases of abscess, gangrene, and interlobar empyema, it is generally positive in purulent pleurisy. An accumulation of pus between the lower lobe of the diaphragm is frequently not reached by the needle because its situation is below the level of the generally recognized safe point for exploratory puncture.

Bacteriology.—It is a mistake to regard the bacteriology of purulent pleuritic effusions as an important factor in the selection of treatment. The fact that pure metapneumonic empyemas sometimes are cured spontaneously should be disregarded, and it would be well, furthermore, to forget that repeated aspirations of pneumococcus pus have also resulted in cure. Every unilateral empyema should be drained by an operation, whether the material obtained in diagnostic thoracentesis is pure pneumococcus, streptococcus, staphylococcus, or the three combined. In reviewing the statistics of writers on the bacteriology of this subject, one is convinced that their conclusions regarding the relative frequency and virulence of the different injections are of interest in prognosis, but of no significance as regards treatment. Undoubtedly the pneumococcus infections are the most benign, but free drainage should nevertheless be employed. A streptococcus empyema secondary to streptococcus infection of the abdomen or elsewhere in the body is more virulent and more unfavorable in prognosis, but all forms of empyemas, regardless of their origin and bacteriology, should be recognized promptly and drained freely, re-expansion of the lung being the main purpose from the outset.

Purulent pleurisies may be divided into three groups—acute, subacute, and chronic empyemas.

Treatment.—Before considering the forms of treatment suitable for these three groups of cases, there are certain general considerations applicable to all. Intermittent aspiration of pus from the pleural cavity is an abandoned treatment. It is justifiable in one instance only. In bilateral purulent pleurisy, when open drainage has been established on one side, thoracotomy of the opposite pleural cavity is attended with the well-known dangers of double pneumothorax. The quantity of retained septic material may, however, be reduced by needle aspiration of the unoperated side.

Intercostal drainage should never be employed except when a fluid is watery in character. A non-collapsible, stiff-walled tube or trocar should alone be used. The adequacy of the drainage must be constantly under observation by one who recognizes the distinction between complete and incomplete removal of septic material.

ACUTE EMPYEMAS

The group of acute empyemas includes those cases recognized within one week of their probable onset. The fluid may be infected but not markedly purulent, or if purulent, a fluid of thin consistency. The lung, though partially compressed, is yet mobile, the pseudomembrane which covers the visceral pleura in the later stages is not developed, and the tendency of the lung after removal of the fluid is to re-expand.

Treatment.—No better argument can be offered in behalf of early recognition of purulent pleurisy than the speedy recovery of most cases operated in the early stages. Patients so handled, though provided with inefficient drainage and lack of any kind of suction, frequently recover promptly, for the reason that the lung is yet mobile and can aid in the evacuation of residual pus. The literature on this subject abounds in reports of small groups of cases with uninterrupted recoveries of short duration, treated with or without particular methods of drainage or suction, and the recovery of such cases should be credited to their early recognition more than to the method of handling.

If a true general empyema is present and promptly detected, as in the early stages of resolution of pneumonia, there is reason to believe that the lung not only retains its expansibility, but is not sufficiently adherent to prevent ready expansion. In the acute empyema cases it must be admitted that with good drainage at the lowest possible point, prompt recoveries are common without artificial methods of expansion. If, on the contrary, such cases were drained with a tube and no dressing were applied covering the tube, in other words, were so handled that air could pass freely in and out of the chest, re-expansion of the lung would be impossible, and such a case would necessarily result in the permanent cavity formation—chronic empyema. If the diameter of the tube is equal to or greater than the diameter of the laryngeal opening, by the well-known principles of physiology the normal negative pressure within the thorax will be lost, and if atmospheric pressure exists within the chest, the normal elasticity of the lung in the absence of adhesions (which is assumed in this group of cases) will result in its retraction. The explanation of the recovery in such cases without artificial suction, seen most commonly in children, probably rests in the fact that the drainage orifice is always covered with a pus-soaked mass of gauze which covers the opening more completely at inspiration, resulting in a partial negative pressure between the pleural layers which inflates the lung. All expiratory efforts with the glottis closed, as in coughing, produce a positive pressure within the lung of the unoperated chest, which in turn partially inflates the lung of the diseased side, at the same time forcing intrapleural air out of the drainage opening. When the latter is partially or completely closed at the next inspiration, the lung is more and more expanded, until adhesions form in the expanded condition, thus gradually obliterating the pleural cavity, from which, by the same process, the pus has slowly been evacuated.

Granting, then, that all cases of acute empyema with a drainage opening of 1 cm. would result in partial retraction of the lung and the existence of a permanent cavity if the thoracotomy wound is not partially or completely closed at inspiration, we are forced to admit that either a valvular action must be provided at the point of drainage or that actual suction must be applied. Many operators who disclaim the necessity of artificial suction are unmindful of the fact that in all of their cases the normal suction effect of the expansion of the chest-wall has been preserved to a greater or less degree by the mere application of the gauze dressing to the drainage orifice.

Despite the efficiency of the simple gauze dressing in many cases of acute empyema, it cannot be regarded as a sure method of preventing a partial collapse of the lung, with the development of a form of empyema represented in our second and third groups.

The gauze dressing should at least have the support of the mackintosh dressing recommended by A. T. Cabot in 1882. After the resection of a piece of rib and the introduction of a tube or tubes, a sufficient amount of gauze is placed about the tube openings to take up the secretion. A large sheet or rubber dam is then laid over all, extending sufficiently beyond the gauze dressing to come in contact with the skin in all directions. It has been furthermore suggested to smear the under surface of the rubber sheet with an ointment to increase its adhesion to the skin. Circular bandages of rubber and gauze have been utilized for the same purpose.

It is not essential to be assured that such mackintosh dressings are actually air-tight to convince one that their value is unmistakable.

The main object of the dressing is to support the effect of the pus-soaked dressing, namely, to close the drainage openings at the moment of inspiration, at the same time allowing the escape of pus at expiration. This valvular action need not be perfect to aid in the expansion of the lung. The more leakage, the less the expansion; but the chances of leakage with a well-applied rubber dressing are far less than with the application of gauze and cloth binder.

In early cases of empyema, such as we include in the first group, are more effective suction methods indicated? The answer to this question is dependent upon the willingness and ability of the operator religiously to observe and adjust a suction mechanism during the convalescence. If the application of a suction device in empyema sacrifices for even a short time the complete and uninterrupted removal of septic material, it should not be employed. If the convalescence is to be in charge of a less painstaking surgeon or physician, who may disregard the blocking of his apparatus, it is better to leave a generous drainage opening, with the application of a rubber dam dressing, as a result of which drainage of infection is automatically complete, although the re-expansion of the lung may be less prompt than with the application of any method of air-tight suction. It cannot be denied, however, that the use of perfected suction in the early cases is the ideal method in the hands of painstaking technicians; but it should be emphasized that air-tight suction should not be employed in all acute cases by any operators, nor even in certain cases by all operators.

One accustomed to recognizing the great variety of empyemas of acute form, and the difference in the tolerance of patients subjected to operation, can appreciate the occasions when a "tap" is preferable to an open drain. An infected non-purulent fluid may often be tapped and not drained. The resistance of a thoroughly septic individual in the first days following operation is sometimes better maintained by the introduction of a tap than by the establishing of an open drainage. By tapping I mean the air-tight introduction of a clamped tube, which may be opened under suction intermittently to allow the escape of fluid, though kept closed in the interim. There are three methods of accomplishing this: (1) A square piece of rib may be excised and a single, round, stiff-walled tube inserted, the intercostal tissue and skin being sutured tight around it. Such a tap will remain air-tight from four to five days. (2) A large trocar may be inserted in an intercostal space and replaced by a tight-fitting Nélaton catheter inserted through it (Buelau). (3) A round hole may be trephined in the rib, with the introduction of a threaded metal tube prolonged with a clamped rubber tube (Robinson). All these methods may be employed under local anesthesia. The fluid is not allowed to escape entirely at the time of operation. The tube is clamped before that point is reached at which air will enter at inspiration. In other words, a hydrothorax is not at once converted into a hydro- or pyo-pneumothorax. The patient is put to bed with, as it were, a closed faucet in his chest and not an open drain-pipe. The partial removal of fluid or pus has permitted the summary expansion of the lung. The impaired breathing has been made easier. The temperature falls by lysis. On the second day a canula and suction syringe or pump is applied to the tube, the clamp removed, and the remainder of the material withdrawn. In three days, air not yet having entered the pleural cavity, the lung has assumed a more expanded position and tends to become adherent. When suction is applied on the fourth day, there may be no reaccumulation of fluid. When necrosis of the tissues surrounding the tube results in leakage, the remaining empyema cavity is greatly reduced in size, and may, in the cases of infected non-purulent pleurisy, be entirely obliterated.

It is undeniable that the convalescence of a small group of cases of acute empyema can be greatly shortened by one of these three methods, the safeguard being that when the temperature and leukocytosis indicate that the mere tapping of the chest has been insufficient to remove the infection, continuous suction drainage can be established by connection with a Bunsen pump, with hydrostatic pressure by water-bottles, with a Politzer bag, or with a siphon suction produced by connecting the drainage-tube with a column of water to a basin.

I repeat that these methods of air-tight suction to which we have referred are dangerous methods if employed in unsuitable cases, or if established by those unwilling or unable constantly to observe the effects.

For the routine treatment of acute empyema, resection of a rib and the employment of the mackintosh dressing is the one of choice. The development of a purulent pleurisy from a non-purulent effusion is difficult to avoid with open drainage, and the adoption of the air-tight suction methods in such cases and in those in which the fluid has recently become purulent is indicated to prevent the occurrence of subacute or chronic empyema.

SUBACUTE EMPYEMA

I apply this term to that group of cases which have passed the acute stage but cannot be regarded as belonging to the third group. From one to six weeks have elapsed since the probable beginning of pus accumulation, the loss of time being explained by the several factors which have been enumerated at the beginning of this chapter. Symptoms of toxemia are present, though not in the acute form. Compression of the lung has been of sufficient duration to render it partially fixed in its retracted position. A pseudo-membrane has formed overlying the visceral pleura which tends to prevent the re-expansion of the lung after removal of pus.

A large majority of the cases which come to operation unfortunately belong to this group.

Given one of these cases of neglected purulent pleurisy, one should remember at the outset that the tendency of the lung is to remain retracted, and that neglect of this feature may result in a chronic empyema. The mere resection of a rib with introduction of a drainage-tube and application of a gauze or mackintosh dressing may be sufficient to remove the infection, but inadequate to accomplish re-expansion of the lung.

The thoracotomy wound should be sufficiently large to admit the forefinger for exploration. The lung is rarely so far retracted that it cannot be reached by the examining finger. The anesthesia should at this moment be light. Forced expiration or spasmodic movements with the glottis closed will tend to reinflate the palpated lung. If it expands materially and tends to follow the finger in the direction of the wound, it may be concluded that the pseudomembrane has not yet prevented re-expansion. If, on the contrary, the lung is immobile and the examining finger passes from the visceral to the parietal pleura as though the latter were adherent, indications are present that a chronic empyema will ensue if measures are not taken to free the lung.

A true decortication operation is not essential at this time, and the lung may often be digitally freed, the finger being forced along the point at which the edge of the retracted lung is continuous with the parietes—in other words, the adhesions between the visceral and parietal pleuræ are at this point broken. The permanent drainage should not be introduced until the operator is satisfied that the lung is sufficiently free to tend to re-expand.

It is at this stage in this group of late cases that carefully applied and faithfully observed efficient suction is the indicated treatment.

The use of the more effective air-tight methods mentioned under acute empyema, such as the intercostal trocar and the rib-trephining method, has been sacrificed by the necessarily large opening to admit the examining finger. Furthermore, these two small-opening methods are less applicable to this group of cases. It is not necessary to enumerate here the different ways of introducing drainage-tubes with tight surroundings. Suffice it to say that the most effective method is to introduce a single or double tube supplied with a rubber collar which, after suture to the skin around the tube, may be hermetically sealed to the skin, preferably with the use of gutta-percha or even with ointment and adhesive strapping. A form of constant suction drainage should then be applied to the tube, the efficiency of which will depend upon the efficiency of the apparatus and the method of its application. The simplest form of suction is siphon drainage, consisting in a continuance of the chest drainage-tube to a basin on the floor by a piece of rubber tubing, the basin and tubing both containing antiseptic fluid.

The freeing of adhesions in this group of cases without subsequent suction is an incomplete fulfilment of the indicated treatment, as a result of which the expansion gained by the digital breaking of adhesions may be sacrificed by the lack of subsequent suction.

CHRONIC EMPYEMA

This group includes those cases of acute empyema which have been subjected to prolonged neglect, those which have become *empyema necessitatis*, those which have been drained insufficiently by operation, and, furthermore, those cases of acute and subacute empyema in which the re-expansion of the lung has not been duly considered and the membrane restricting the lung has become a thick, leathery partition incarcerating the lung in its retracted position. The patient presents the well-known picture of chronic sepsis, with a low and even normal temperature and moderate leukocytosis. The infected chest is stationary, the ribs are approximated, and the consequent scoliosis is visible.

It is claimed by certain writers that after prolonged suction treatment the lung may be made to re-expand even in the presence of chronic empyema. This fallacy is accounted for in one of two ways. Either the case is not a true chronic empyema, or one of the less neglected subacute cases of our second group in which the pseudo-membrane restricting the lung is still elastic; or else the operator has applied a suction apparatus for so many months that the pleural space has been obliterated not by the re-expansion of the lung, but by pleural thickening and the partial formation of granulation tissue.

The three possible methods of treatment in chronic empyema are: decortication, the use of antiseptic mixtures, and osteoplastic rib-resection.

The first duty of the operator is to determine whether the lung, now restricted, if not deprived of its function, is beyond the possibility of restoration. Either the lung must be brought wholly or partially to the chest-wall, or the regain of lung function must be sacrificed and the cavity obliterated either by approximating the chest-wall to the lung, as by plastic operations, or the cavity must be sterilized with antiseptic paste and closed in, remaining as a sterile cavity, to be filled in subsequent months and years by pleural thickening and granulation tissue.

It may be said that a fatality following operation for chronic empyema is inexcusable. It should be remembered that even without operation patients thus afflicted may live many years without great discomfort and without complete disability. In choosing the method of treatment the duration of the disease, the extent of amyloid degeneration, the age of the patient, and the size of the persisting cavity should all be taken into consideration. The smaller empyema cavities may be cured by sterilization or by plastic operations in several stages. The larger cavities may best be reduced in size by a complete decortication or by a partial decortication in conjunction with rib-resection.

Fatal results occur in rib-resection operations when a too extensive operation is performed. The loss of blood is considerable from many oozing bleeding-points. The resection should be suspended before the patient's condition becomes threatening, because post-operative collapse is the usual occasion of fatal outcome. Equally good results may be obtained by operation in several stages, the shock of each being reduced, the end-result being equally good.

Decortication is a procedure which has been by no means universally accepted. Theoretically, to say the least, it is the ideal treatment of these chronic cases, inasmuch as the restoration of function and obliteration of the cavity go hand in hand. The partial rib-resection essential to permit of this decortication operation aids somewhat in reducing the cavity. An attempt is justifiable if the procedure is abandoned when found in a given case to be difficult. If an area of cleavage is not readily found, and hemorrhage and escape of air are excessive, the attempt should be promptly suspended and one of the other safer methods resorted to.

Decortication.—This operation of Delorme and Fowler consists in the resection of three ribs for 3 or 4 inches, with the removal of the thickened visceral pleura. If when freed from its incarceration the lung tends to reinflate at expiration, the operation may be completed by further stripping the thickened parietal pleura, as a result of which two freshened surfaces come in contact and the lung may again become adherent in its re-expanded state. If the visceral pleura does not yield to the stripping process because an area of cleavage between the lung parenchyma and the pleura is not present, or because in the process excessive hemorrhage results, one should be satisfied with multiple incisions in the visceral pleura running parallel to one another, or in gridiron fashion. If complete re-expansion of the lung is not thus permitted, it is at least favored, and the cavity remaining to be obliterated by further expectant or operative treatment is reduced in size.

The element of danger to life is unquestionably present if this operation is carried beyond its limitations. Though often successful it has not infrequently terminated fatally, and is by no means applicable to each and every case. I repeat, however, that the attempt is justifiable if the method is abandoned when found difficult.

Antiseptic Paste Method.—As we have before mentioned, the use of bismuth and vaselin paste, as recommended by Beck, is not inconsistent with the re-expansion of the lung in the acute and subacute stages, acting meanwhile as a valuable antiseptic agent to reduce the absorption of septic material. Given, however, a case belonging strictly to the chronic empyema group in this classification, there is no reason to believe that the cavity is filled by any re-expansion of the lung. This treatment, therefore, should not be too promptly employed until the feasibility of decortication has been considered. If, on the contrary, the cavity is found to be a shallow one, though perhaps over a considerable area, or if a previous larger cavity has been reduced to a smaller one by decortication, the antiseptic paste treatment is indicated previous to osteoplastic resections. Although at its adoption the hope of further lung expansion is abandoned, the maintenance of the conformity of the chest-wall is observed, a feature of which is disregarded in all plastic operations. It is a mistaken idea, for which the originators of this treatment are not responsible, that a cavity of more than 10 ounces' capacity should be filled with bismuth paste without provision for at least a partial escape of the material. The walls of the cavity are coated, and, together with the residual amount which does not escape in the dressing, they serve to sterilize the cavity. This may not occur with the first injection. After repeated introductions of bismuth and vaselin the pus discharge is diminished in quantity, the drainage opening tends to heal, and should be allowed to close when the discharge from the cavity ceases to contain bacteria. When the skin wound is closed, a cavity of varying capacity persists; but being sterile and ceasing to excrete, the patient gains in weight and has to all appearances recovered. The obliteration of the cavity which then ensues occurs partly by pleural thickening and probably by the far greater formation of granulation tissue than we are accustomed to see overlying infected thickened pleura. Just how soon such cavities are entirely obliterated has not yet been determined; neither is this factor of great importance, inasmuch as the patient may recover completely in spite of it. Acute or chronic bismuth poisoning are to be regarded as complications in connection with this treatment.

Plastic Operations.—The removal of greater or less portions of ribs to cause the chest-wall to cave in to the retracted lung, thus obliterating the empyema cavity, has been the most popular method of treating the disease. It may never be replaced entirely by either the decortication or antiseptic methods, but it should never be employed without a previous consideration of the advisability of decortication, and rarely employed except when bismuth paste has failed to reach the limits of a cavity sufficiently to sterilize it. Even if the plastic operation is eventually resorted to, the antiseptic paste method should be employed subsequent to the rib-resection, to hasten the ultimate obliteration of the cavity. Hideous chest deformity and sacrifice of restoring function to the lung are both attendant upon the choice of this method; and to choose it without consideration of the other methods is unjustifiable.

Not uncommonly associated with a chronic empyema cavity of long standing is one or more bronchial openings through which a certain amount of drainage occurs, especially before the establishment of an external drain. Decortication may not be of value in such cases unless the bronchial opening can be closed at the time of operation. If this is not successful, re-expansion of the lung is difficult in the presence of a bronchial leak. The employment of bismuth in such cases results in expectoration of a certain amount of the paste, and it is not inconceivable that infection from the bronchus may recur in the cavities first sterilized by the antiseptic paste. In such cases a Schede or Estlander operation is indicated, an attempt being made to approximate the skin and muscle flap to the region of the bronchial opening.

While large chronic empyema cavities are unmistakably due to gross neglect in the treatment of the earlier stages, cavities of moderate size will always exist as a sequel to the incomplete re-expansion of the lung in many cases where due effort in this direction has been expended. These smaller cavities are best suited to the employment of the antiseptic paste; decortication is less essential, and plastic operations should be considered as a last resort.

Differential Pressure.—Great enthusiasm has prevailed within the past five years concerning the use of positive or negative pressure during thoracic operations. Its value consists largely in the prevention of lung collapse during operations on deep-seated lesions. We have referred under different headings to certain infectious diseases in which its use is contributory. All of the well-recognized operations for infectious diseases which we have considered can be safely done without inflation apparatus. The fact remains, however, that with the use of differential pressure in certain operations the results should be better and the convalescence shorter. To enumerate the occasions when differential pressure may be of assistance in the surgical treatment of thoracic infections:

1. In certain cases of metapneumonic empyema in which it may seem advisable to reinflate the lung and close the wound. This procedure has met with varying success with different operators. The tendency is toward the encapsulation of septic material in one or more places after the lung inflation. If such occurs, a secondary operation is necessary. It is probable that the same operation plus the introduction of an antiseptic fluid may sterilize the remaining material and complete the cure. This method of treating empyema can apply only to the very early cases, and should be attempted with caution.

2. For all intrathoracic operations in which the absence of adhesions is suspected, a complete collapse of one lung being a fatal occurrence in certain individuals susceptible to a wide-open pneumothorax. Adhesions may be absent in early empyemas and in bronchiectasis. Excision of a bronchiectatic lobe is accomplished with greater ease and less anxiety with the use of differential pressure. If an operative pneumothorax should prove threatening in a case of acute empyema, the several older methods of meeting this emergency, such as plugging the thoracotomy wound, or drawing the lung into the wound, may be employed. I doubt the value of differential pressure, therefore, in empyema operations.

3. Operations for lesions, such as abscess and gangrene or bronchiectasis, to prevent the aspiration of blood or pus to the opposite lung. When local anesthesia is not possible for such operations, the dangers of aspiration during general anesthesia can thus be reduced.

4. In deep-seated abscess or gangrene of the lung a one-stage operation is made possible by the use of differential pressure. (See treatment of abscess.)

TUBERCULOSIS

It is to be regretted that the operative drainage of tuberculous cavities and the excision of tuberculous portions of the lung have not been attended with more promising results. Nor can it be said that this method of attack will ever prove to be a particularly contributory one. Although tuberculous cavities have been drained of secondary infection with temporary relief, the remaining foci of disease have generally been sufficiently extensive to prolong the disease to its usual termination. The cases of Tuffier and Lowson remain the sole examples of successful removal of tuberculous lung apices. Those early cases to which the disease is thus limited and amenable to complete excision are the very cases in which the non-operative hygienic methods provide the greatest promise of cure.

Immobilization Therapy.—The surgical procedures of greatest value in pulmonary tuberculosis are those which reduce the activity of the lung by restricting its mobility.

No feature in the therapeutics of tuberculous infection is more generally accepted than the element of rest; in other words, the immobilization of the diseased part. For example, the promptness with which an acute tuberculous infection of joints responds to the application of a plaster cast convinces one of the value of immobilization therapy.

It may be argued that nature seeks to reduce the mobility of a phthisical lung by restricting the activity of the thoracic muscles of the infected side. The affected chest becomes almost stationary; the normal convexity of its wall becomes flattened as a result of approximation of the ribs. A partial fixation of the lung thus results from the presence of the disease. The general toxemia reduces the patient's ambition, and, accepting this hint of nature, we prescribe inactivity. Associated with the quiet breathing accompanying absolute rest in bed are evident diminished toxemia and a bettered general condition.

The formation of a pleuritic exudate is recognized as a further effort of the disease to combat itself. Spengler, Adams, West, Forlanini, have emphasized the importance of respecting this condition and allowing the fluid to exert its compression upon the lung, thus further immobilizing it. While removal of such fluid has not infrequently hastened death, its maintenance has reduced fever, diminished the sputum quantity, and limited the toxemia, thus bettering the patient's condition.

Spontaneous pneumothorax due to tuberculous necrosis and rupture of the lung, though once regarded as a threatening occurrence in the course of lung tuberculosis, is now accepted as an automatic effort to check the disease. Spengler reports ten cases in which he has recognized the value of this complication, allowing the subsequent accumulation of fluid to reach the level of the rupture, the exudate thus favoring its closure. The fluid was removed in small quantities when its accumulation became excessive. Six of Spengler's ten cases complicated with hydropneumothorax recovered completely.

Evidence is not lacking, therefore, that certain sequels associated with pulmonary tuberculosis are intended to limit the disease by immobilizing and splinting the lung. The discovery of the therapeutic value of spontaneous hydrothorax and pneumothorax led to the conception that similar conditions artificially produced might also tend to arrest the disease.

Artificial Pneumothorax.—This form of therapy was first suggested by Forlanini and independently conceived by J. B. Murphy. It consists in the repeated injections of from 300 to 1800 c.c. of a slowly absorbable gas into the pleural cavity to permit and maintain for an indefinite period the collapse of a diseased lung.

Our knowledge of the pathologic changes which occur as a result of this therapy is obtained from but four reported autopsies (Graetz, Lemke). There appears a marked connective-tissue formation in the region of tuberculous cavities, resulting in their cicatrization and contraction. A similar cicatrization is seen about the isolated caseous areas. A striking tendency to callous formation is found in the region of the vessels and bronchi, indicating the healing of perivascular and peribronchial inflammatory processes.

There are conflicting theories as to the probable explanation of the effect of artificial pneumothorax on the tuberculous lung. The compression alone is doubtless of fundamental importance. The cubic contents of the previously existing cavities are diminished, to which fact the concurrent diminution in the sputum quantity bears testimony. The diminished amount of retained infectious material retards the activity of the tuberculous process, the immobility of the tissue lessening, furthermore, the transference of infectious material from one alveolus to another. There is a tendency, moreover, to localize and encapsulate the smaller cavities.

Changes in the blood and lymph circulation must also be accepted as contributory factors. Czerniki credits the effect of pneumothorax to an anemia which results from the compression, as a result of which he argues that both the bronchial and cavity secretions are lessened. It has been suggested, furthermore, that a condition of passive hyperemia, as therapeutically produced by Bier, may take place. There is not yet sufficient evidence that a distinct change in the pulmonary circulation occurs in the presence of pneumothorax to justify the acceptance of the circulatory theory. Animal experiments have been conflicting in this regard, and it is disputable as to whether the contracted lung contains more or less arterial or venous blood. In fact, there is experimental evidence that the pulmonary circulation adapts itself promptly to the change, and is therefore not particularly disturbed.

There are reasons for believing that changes in the lymph circulation are responsible for the clinical and pathologic changes which occur after the establishment of pneumothorax. This is demonstrated clinically by evidences of diminished toxic absorption, namely, a fall in temperature, a reduced number of night-sweats, and a rise in the opsonic index (Pigger). It would seem more consistent to ascribe this to a retarded lymph circulation than to an altered blood distribution.

Different forms of apparatus have been utilized, the principles of which are not unlike. The author's is shown in Fig. 16. Nitrogen gas previously stored in one of two bottles is forced by the hydrostatic pressure of water in the other through the metal and rubber tubing to a hollow needle which has previously been introduced into the thoracic cavity. The manometer may be connected by properly adjusting the several cocks, so that either the intrathoracic pressure may be recorded or the pressure under which the nitrogen is entering the pleural space.

Skill is required in so adjusting the needle point that it is not embedded in lung tissue. Three fatalities have occurred from the production of air embolism by the injection of nitrogen gas into a pulmonary vein. To avoid this accident Brauer advocates a small incision through the skin and underlying tissue. The exposed parietal pleura is then punctured with a blunt needle and lung injury is quite impossible. Forlanini denies the necessity of this precaution and inserts the needle as in ordinary thoracentesis.

The author has employed both methods without accident. The puncture method is unquestionably attended with danger in inexperienced hands, and although its adoption may be subsequently justifiable, the incision method should at least be used by the beginner.

The manometer must be employed as the guide to the position of the needle point, and nitrogen must not be allowed to flow until oscillations of the manometer indicate that the pleural space is entered.

It is obvious that the chances of symptomatic relief and the probability of ultimate cure by this pneumothorax therapy are dependent largely upon one factor, namely, the extent to which existing adhesions may permit retraction and compression of the lung. The lung collapse will occur in proportion to the extent of the pneumothorax; the degree of pneumothorax will correspond to the available pleural space, which, in turn, is dependent upon the extent and firmness of adhesions.

The entering nitrogen gas will seek the course of least resistance, and it must be remembered that the pressure under which it is introduced is not intended to be great enough to force apart any but light adhesions. Not infrequently an encapsulated pneumothorax is established occupying an area of not more than 8 inches in diameter. Since firm adhesions border this area, the pleural layers are probably not separated more than an inch; a shallow limited space is thus established permitting but slight lung collapse, with a consequent insignificant relief. If, on the contrary, a larger area is free of adhesions, the retraction of the lung is correspondingly greater and the results more gratifying. The most nearly ideal conditions are those in which the adhesions are, though perhaps extensive, limited to the upper portion of the chest—in other words, where the disease is confined

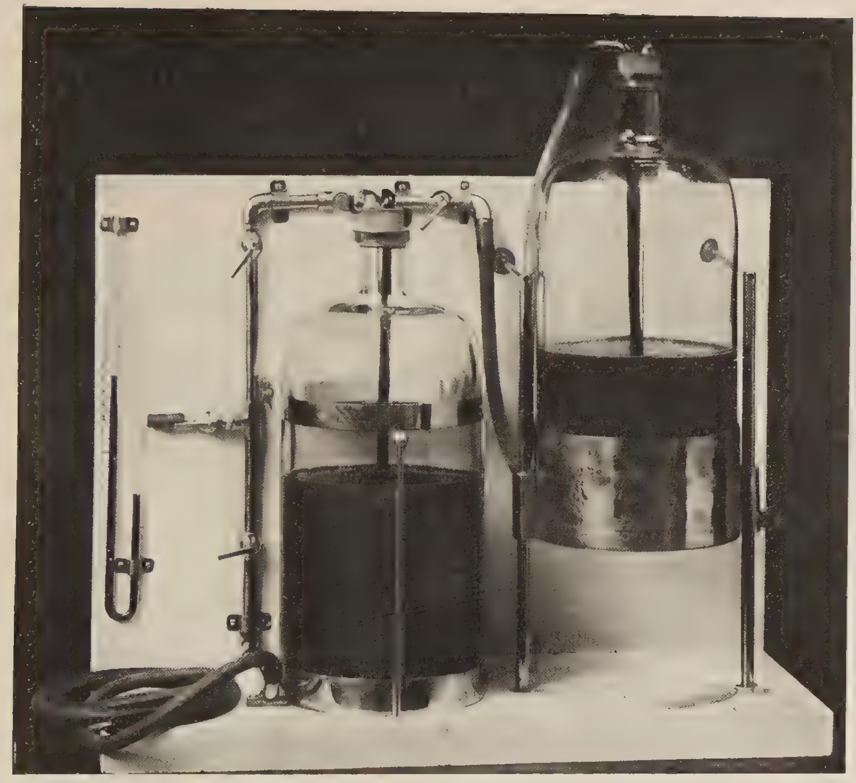

Fig. 16.—Robinson's apparatus for nitrogen injection to establish artificial pneumothorax, showing method of obtaining slight hydrostatic pressure.

largely to the upper lobe. In such cases the introduced nitrogen not only follows the periphery, but occupies the space between the diaphragm and the lower lobe. If adhesions are not present between the latter surfaces, a pneumothorax of considerable extent is established and the lung retracts to the adherent areas of the upper thorax. It is in this last group of cases that the greatest benefit in treatment may be expected.

Inasmuch as adhesions are generally least prevalent in the earlier stages of phthisis, it might be argued that the first-stage cases are most amenable to this treatment. The fact that pneumothorax can be easily established in such cases is by no means a proof that it should be. These cases are ordinarily cured by methods of hygiene, and there is no reason to believe that pneumothorax therapy should be substituted when suitable institution or home treatment can be carried out. If such means are not at hand in a given case, the pneumothorax treatment may be indicated.

Pneumothorax therapy is especially indicated in that group of cases advanced just beyond the promise of relief by methods of hygiene; and a distinction should be made between those cases regarded as hopeless simply because they do not respond to hygienic treatment, and those advanced cases which are rapidly approaching their termination. The former group should be treated with artificial pneumothorax; the latter also for symptomatic relief, but not with the same hope of arresting the disease.

Bilateral involvement, when the disease of the less affected side is apical, should not be regarded as a contraindication, for the tendency of pneumothorax on one side is to arrest the activity in the opposite apex.

The symptomatic relief attendant upon pneumothorax therapy is unquestionable. This relief of symptoms is entirely in accordance with the pathologic changes which appear to exist. The most conspicuous benefit is apparently derived from diminished toxic absorption, not only from the toxins of tuberculosis, but of those resulting from the mixed infection present in phthisical cavities. A lowering of temperature is apparent in those cases which have been attended with fever, especially when a considerable amount of gas has been introduced. This fall in temperature, sometimes of immediate occurrence after the first injection, may be temporary and followed by return of fever. Subsequent injections tend to lower the temperature at the time, and eventually it may remain permanently normal. A diminution in the frequency and extent of night-sweats is not infrequently noted. An improvement of the general condition of the patient, with increased appetite and gain in weight, is undoubtedly further proof of the reduced toxemia.

A diminution in the quantity of sputum has been the most conspicuous element. Though perhaps increased for the first twenty-four hours after the introduction of pneumothorax, which doubtless results from partial evacuation of cavities under lung compression, there is a subsequent falling-off in the twenty-four-hour amount. In addition to the diminution in sputum quantity, it is often noticeable that the total number of tubercle bacilli in a given microscopic field is reduced.

Hemoptysis is generally controlled and frequently permanently arrested.

Pulmonary tuberculosis has been definitely arrested by this treatment. Some of the cases reported by Brauer, Spengler, and Forlanini have been without recurrence for a sufficient length of time to indicate permanent cure. A large majority of all cases reported as subjected to this treatment were well advanced.

There is ample reason to conclude that artificial pneumothorax therapy should be included as an established treatment in certain selected cases from those which are commonly abandoned as beyond the hope of cure by other methods.

DISEASES OF THE RESPIRATORY SYSTEM IN CHILDREN

BY ISAAC A. ABT, M.D.

THE same factors which produce respiratory diseases in adults are active in children. The micro-organisms involved are the pneumococcus, bacillus of Friedländer, influenza bacillus, streptococcus, staphylococcus, tubercle bacillus, diphtheria bacillus, and occasionally the typhoid bacillus. The manifestations which these organisms produce are in many ways similar to those occurring in the adult. The respiratory changes may be caused by the enanthem erupting on the mucous surfaces in the exanthematous diseases—measles, scarlet fever, varicella, and variola; or they may result from obstruction to the respiratory passages by adenoids, enlarged tonsils, and bronchial lymph-glands. These factors are often the predisposing causes for diseases of the respiratory passages, because an exceedingly slight obstruction will cause difficulty in respiration through the narrow bronchi and larynx. In cases of marasmus or cachexia, due to protracted disease, the respiratory passages of the child are subjected to inflammation. This may be due to the accumulation of secretions in the lungs, or pneumonia may be produced by aspiration of food and liquids into the bronchial tubes. Metastatic and hypostatic pneumonias may explain the terminal condition so often discovered on autopsy.

The pathology of respiratory diseases differs from the adult type in the size of the air-passages and the amount of tissue involved. In the adult a marked swelling of the laryngeal mucosa may produce little or no dyspnea or cyanosis; in the infant symptoms of stenosis, or even asphyxia, are readily produced by a like condition. In most cases a diffuse inflammation occurs in the entire respiratory tract, from the nose and pharynx to the finest alveoli. This is especially observed in the exanthematous diseases, and in this group we often find an affection of the passages leading from the nasal orifices, *e. g.*, the Eustachian tubes and the middle ear. In the presence of adenoids, only a slight inflammatory process is required in the nasopharynx completely to occlude the Eustachian tubes and obstruct nasal respiration. In addition to the changes which occur in the trachea, bronchi, and lungs, direct or metastatic infections of the serous membranes frequently occur. Suppurative arthritis and peritonitis are occasionally observed in pneumonia of childhood. In the infant pleuritic effusions are usually purulent. As the age of the child advances serous effusions are more frequently encountered, though empyema may occur at any age.

The symptoms of respiratory disease of the child differ from the same conditions in adults.

1. The normal narrowness of the larynx and bronchi, plus the in-

flammatory process, tends to produce more or less complete occlusion of the part or parts involved; as a result dyspnea and cyanosis are often pronounced, even when the pathologic changes are relatively slight.

2. The fever is usually higher than with a corresponding process in the adult. Fever in children of itself produces rapid respiration, even in cases where the air-passages are not diseased. It is essential that the muscles of the chest which are active in the process of respiration perform no more work than is necessary.

3. Infants and young children do not expectorate. Sputum raised from the bronchi by productive cough is swallowed and gastro-intestinal disturbances frequently result. On the other hand, in weak children the sputum may be retained in the bronchi or lungs, causing extension of inflammation or producing the symptoms of pus retention.

It is thought that myocarditis is less frequently a complication of pneumonia in infancy than in childhood.

Though the pulse is frequently rapid, cardiac dilatation does not occur until the heart muscle has been weakened by degenerative processes.

ACUTE LARYNGITIS

Acute laryngitis is frequently a part of a combined infection of nose, pharynx, larynx, and bronchi. It occurs after "grippe" infections or with the exanthematous diseases or in association with obstruction to respiration, particularly by adenoids and enlarged tonsils. Laryngitis is commonly caused by infection with the streptococcus, staphylococcus, or diphtheria bacillus. Occasionally other micro-organisms, such as the pneumococcus and influenza bacillus, are found. The mucous membrane of the larynx becomes swollen, desquamates in parts, and there is an excessive secretion of mucus. In young children and infants comparatively little edema is necessary to occlude the larynx entirely. The diphtheria bacillus, and occasionally the pneumococcus or streptococcus, may produce a fibrinous membrane covering the entire larynx and causing stenosis. Most of the symptoms of the disease, as dyspnea, cyanosis, rapid pulse, and recession of soft parts of the thorax, are due to the mechanical obstruction. The toxic symptoms of laryngeal obstruction are those which result from asphyxia and carbon-dioxid poisoning, in contradistinction to the bacterial toxemia of acute infective processes.

The indications for treatment are the removal of the obstruction: (1) By reduction of the swelling; (2) by removal of the secretion; (3) if necessary, by producing an artificial air-passage; (4) by reduction of temperature.

Prophylactic measures may be employed to prevent recurrent attacks of the disease. Adenoids and enlarged tonsils should be excised, if laryngitis or bronchitis is frequent. Various methods of hardening children are recommended. These procedures should not be too strenuous nor begun too early in life. The following plan is suggested:

From the end of the first month, after the usual warm bath, cool water (68° to 70° F.) may be sprinkled over the back of the child before he is dried; the water should not be poured from a height, as the shock is too great. During the first summer the child should not be too warmly clothed; the arms and legs may be bare in warm weather, only the head and abdomen being well covered. This method of exposure may be continued until the end of the summer, except on cold days. If the child is delicate, this method of hardening should be instituted gradually. On the other hand, there can be no doubt that some children are attacked by croup if they are outdoors on a cold or windy day. Overloading of the stomach or indigestion sometimes predisposes to an attack. Children of neuropathic constitution seem especially liable to attacks.

There is no specific treatment for acute laryngitis, except when it is produced by the diphtheria bacillus, in which case the antitoxin should be given as early in the disease as possible in doses of 2000 to 5000 units, depending upon the age of the child. The dose should be repeated in six hours, if there is no relief.

The edema of the larynx is combated by external applications of heat or cold, both of which appear of value at times. Ice applied to the neck, a hot sponge, or a poultice over the larynx seems to afford relief to the child. The food should be liquid or soft. Hot drinks, such as barley-water and linseed tea, sweetened with sugar or saccharin, seem to act favorably. At least they offer temporary relief from the distressing cough and obstructed breathing.

The inhalation of steam is probably the most effective method of treating non-diphtheritic laryngeal inflammation in children. Its action depends on both its power of increasing secretion and rendering it more fluid, so that it is easily removed. The mucous membrane becomes less swollen, and consequently the air reaches the lungs more readily. The room is kept warm (75° to 80° F.) and water is kept steaming in it. In severe cases the steam may be applied more directly to the patient by the use of the steam tent. It is doubtful, however, whether this method has any advantages over the simpler procedure of thoroughly moistening the atmosphere of the sick-room. The stuffiness produced by the tent, the danger of burning the child, and the absence of striking benefit have caused this method to be in most instances discontinued. A kettle of water may be kept boiling near the bed. The effect of the steam is often remarkable—a child with considerable occlusion of the larynx falls asleep within fifteen to twenty minutes and breathes normally within a few hours. It is sometimes necessary to continue the use of the steam for several days until the disease has run its course, though the steaming process should be interrupted at times lest the room become overheated and the atmosphere stifling.

Great care must be exercised in the use of this method. Young children have not infrequently been scalded by the careless use of live steam. Gas flames and alcohol lamps used to generate steam have not infrequently set fire to bed-clothes and furniture. The electric stove, which can be readily attached to any electric-light fixture, is to be preferred, wherever its use is possible.

The apparatus for steam inhalations may be readily improvised. A steam kettle or a teapot, or even an open stew-pan, may be used, or one of the croup kettles supplied in the shops may be employed.

Sodium chlorid, one teaspoonful to a quart of water, or sodium bromid, 1 to 3 per cent., or bicarbonate of soda, 1 to 2 per cent., or the commonly used compound tincture of benzoin (one teaspoonful to a quart), or adrenalin chlorid solution (one teaspoonful to a quart) may be employed for inhalation.

In cases of hypersecretion the oil of eucalyptus, spirits of camphor, oil of turpentine, or oil of gaultheria, in the strength of one teaspoonful to a quart of water, sometimes gives relief.

Calomel fumigations are still recommended by some, but, as a rule, cases severe enough to require this treatment must sooner or later be intubated, and accordingly calomel fumigation has practically fallen into disuse.

The removal of the secretion in infants and young children, as has already been mentioned, is difficult because they do not expectorate. The sputum accumulates in the pharynx; sometimes it fills the mouth or is swallowed. Its presence is easily detected by the gurgling sound produced in breathing. When large amounts are swallowed, vomiting may result from irritation of the stomach, or the mucus in the pharynx may excite emesis. While it is undoubtedly true that in the severer cases vomiting gives temporary relief, by removal of the mucus from the upper air-passages and the pharynx, nevertheless the vomiting is attended or followed by considerable prostration, and stenosis tends to recur. The production of emesis as a routine measure is to be deprecated. Occasionally it will suffice, where the mucus is collecting in the larynx and pharynx in sufficient quantity to produce obstruction, to excite vomiting by tickling the fauces with a finger or a cotton swab, but the stenosis is not, as a rule, caused by mucus; it is due to edema or to local inflammation.

The wine of ipecac in teaspoonful doses, repeated every half hour or hour, until emesis is produced, is as efficient as any other drug of this class. Antimony in $\frac{1}{100}$-grain doses, or powdered ipecac, $\frac{1}{30}$ to $\frac{1}{100}$ grain, may be used every hour or two where the secretion is tenacious and where no immediate emetic effect is desired. Apomorphin is mentioned only to be condemned. The toxic effects of this latter drug are to be feared, and large doses for the production of emesis consequently to be avoided.

Antispasmodics.—Not a few patients are strikingly benefited if repose or sleep is produced. An appropriate dose of the camphorated tincture of opium (5 to 10 drops for a child one year of age) may be given, or a small dose of codein ($\frac{1}{60}$ to $\frac{1}{100}$ grain for a child of one year), or a mixture of sodium bromid and antipyrin (2 to 3 grains of sodium bromid and ½ grain of antipyrin for a child of one year), repeated at intervals of one or two hours until the attacks disappear. In other cases chloral and bromid by rectum induce sleep and cessation of the attacks (3 to 10 grains of bromid and 1 grain of chloral in water or milk, for a child of one year, for rectal injection).

If the temperature is high (above 102° or 103° F.) and the child manifests such disturbances as restlessness or sleeplessness, efforts should be made to reduce the fever. The reduction of the temperature renders the child more comfortable and permits the products of metabolism to be eliminated more perfectly. The elimination takes place by an increase in the amount of sweat and quantity of urine, and a favorable result is exerted on the respiration. The respirations are diminished when the temperature falls. The work of the muscles of the chest and neck is diminished, and a decrease in the number of respirations means a proportionate decrease in the amount of laryngeal obstruction.

Hydrotherapy.—Tepid sponging, cool packs, or warm baths (100° F.), gradually cooled (to 80° or 85° F.), or enemas of cool water will reduce the temperature and cause the child to fall into a restful sleep.

Antipyretic Drug Treatment.—The drug treatment is entirely symptomatic. It is directed toward the relief of the most pronounced symptoms. Usually hydrotherapeutic measures are sufficient for the control of the temperature. If, in spite of them, the fever remains high, the salicylates may be used. Sodium salicylate may be given in 1-grain doses, three to four times a day, to children in the second year; in 1½-grain doses at the end of the second year; 3 grains at the end of the third year, and 5-grain doses to older children. Salipyrin is given in doses half as large. Aspirin (acetyl-salicylic acid) may be given in 1-grain doses, every two or three hours, in the second year; in 3-grain doses in the third and fourth years, and in 4-grain doses in later years. Antipyrin or phenacetin in ½- or 1-grain doses frequently gives striking relief by reducing the temperature as well as allaying nervous manifestations. The use of the coal-tar drugs must not be pushed and their depressant effect must not be lost sight of. In debilitated children, or in cases of marked dyspnea and cyanosis, their use is contraindicated.

If a child is subject to recurrent attacks of croup, general tonic treatment is indicated. For this, arsenic is especially valuable, given as liquor potasii arsenitis, 1 or 2 drops two or three times a day, for three weeks, then omitted for ten days to two weeks. This is done so as to guard against arsenical poisoning. Arsenic should be given preferably after eating. Tincture of stramonium (5 minims), which is an antispasmodic, may be combined with arsenic or sodium iodid (1 to 3 grains). One or two drops of adrenalin solution internally, two or three times daily, have been recommended. It has been thought that this remedy will act favorably in recurring attacks of croup, as in asthmatic seizures.

Intralaryngeal medication is difficult or impossible in infants and young children. In cases where the laryngeal stenosis is persistent and grows progressively worse, and where all attempts at relief of the obstruction have failed, intubation or tracheotomy must be resorted to. Intubation should always be the operation of choice.

CHRONIC LARYNGITIS

Chronic laryngitis is usually produced by mechanical changes in the pharynx or nose, or by local irritation. The mechanical factors are most often adenoids or enlarged tonsils. Chronic infections, such as tuberculosis and syphilis, are sometimes factors in the production of chronic laryngitis. Papillomata of the larynx are not infrequent and should be considered in cases of obscure laryngitis.

The symptoms are usually mild. They are hoarseness, hacking cough, sometimes fever of low grade, except when the disease is complicated by lesions of other organs, rapid pulse, and restlessness. If the swelling of the larynx is great, there is dyspnea and cyanosis.

The treatment depends entirely on the extent of the disease. In infants it is usually not advisable to remove adenoids or enlarged tonsils, unless the symptoms produced by them are severe. After the third year they should be removed whenever there is any indication of their predisposing to disease of the nose and throat. Growths on the vocal cords may require removal. Syphilis is treated by the use of mercury and iodids, as in adults, and tuberculosis by general hygienic measures and fresh air. The treatment of the evident etiologic factors is sufficient in the largest number of cases. If none of these measures is found to be efficient, and one attack of laryngitis follows another in rapid succession, a change of surroundings and climate may be necessary. The climate should be even and moderate; preferably the air should be moist, such as that of the seashore.

ACUTE BRONCHITIS

Bronchitis is a very common affection in infancy and childhood, and may be divided for purposes of description into three types: (1) Primary; (2) secondary; and (3) chronic.

Primary bronchitis is most frequent during the fall and winter and seems to bear a causal relation to exposure. Nutritional disturbances, particularly rickets, malnutrition resulting from improper feeding, and the exudative diatheses predispose to bronchitis. Such infants and children as are improperly housed, or those who live in ill-ventilated rooms, are susceptible. It should be stated that a cough does not always mean bronchitis. Many suffering from affections of the pharynx and nasopharynx, particularly large tonsils and adenoids, or those affected with laryngitis or tracheitis, very often present conditions characterized by persistent cough, which will frequently yield to causal treatment.

In infants and children symptoms of acute bronchitis may be mild or severe. The onset may be sudden, though not infrequently it is preceded by rhinitis, pharyngitis, or laryngitis. Attacks of tracheobronchitis, particularly in children over two years of age, are not infrequent. In these cases the trachea and large and medium-sized tubes are involved. Such attacks present few constitutional symptoms, unless complicated by bronchopneumonia in young and delicate children. Fever and general malaise are slight and in the mildest cases may be absent.

In the severe cases of bronchitis the temperature varies from 101° to 103° F. The normal vesicular breathing is roughened; as a rule, dry râles are heard, though mucous râles are not infrequent. Sometimes sonorous or sibilant râles may be palpated over the chest-wall. As a rule, when the temperature rises above 102°, and continues, some complication must be suspected. Examination will probably reveal a complicating tonsillitis, an intestinal derangement, or a bronchopneumonia.

Prophylaxis.—Acute bronchitis tends to recur, and consequently all children subject to bronchial affections should be especially guarded. Enlarged tonsils and adenoid vegetations, which are common causes, should be removed as early as possible, preferably not before the second year, and not during a febrile attack. Acute coryza must be diligently treated to prevent further extension. Poorly nourished as well as overfed, fat, and flabby infants and children must be placed on a proper hygienic and dietetic régime. Rachitic children should receive treatment for the underlying condition.

At the present writing the fresh-air treatment is very much in vogue. We would not deprecate the value of fresh-air treatment at any season of the year as a valuable agent in the prevention and treatment of bronchial affections, nor can we overlook the fact that in most American homes the living-rooms are overheated and are ill ventilated during the autumn and winter. This condition is not conducive to vigorous and healthy growth. On the other hand, clinical experience forces the belief upon us that infants and children who are put out in a cold, damp, and dust-laden air, with a northerly or northwest wind blowing, are not infrequently attacked by bronchitis. In our rigorous, northerly climate there are stormy days in the fall and winter when prudence and common sense would suggest caution in the matter of taking children outdoors. It is frequently a difficult matter for the physician to decide, and it becomes much more difficult when left to the discretion of the nursery-maid. Infants and children who are chilled so that they become cold and blue, or those who are wheeled against the path of strong wind or a cloud of dust, are not benefited by their outing. I think there must be a middle ground, and believe that while fresh air is beneficial, undue exposure may be harmful. Much will depend upon the individual constitution and reaction of the child, and general principles of procedure must be modified according to individual circumstances.

During the severest weather infants may receive their airing indoors with the windows wide open. The children should be dressed in their outdoor clothes. Those who are accustomed to sleep outdoors in fair weather may sleep indoors with the window open wide, thus securing all the benefits of the fresh air and still be sheltered from the wind. A room with a southern exposure is preferable.

There is no known prophylactic measure for the prevention of bronchitis which accompanies or follows measles, whooping-cough, and some of the other acute infections. For instance, in measles the bronchitis is due to the invasion of the bronchial tubes by the morbiliform eruption; the so-called enanthem of the bronchial mucosa is an inevitable part of the disease process. That fresh air, well-ventilated rooms, and frequent change of position in bed may prevent capillary bronchitis and bronchopneumonia is a fact that is attested by most clinicians, though in rachitic, weakly, and poorly nourished children all of our present measures of prophylaxis will sometimes fail.

Treatment.—*Hygiene.*—The room should be large and ventilated in such a way that no draft strikes the child. The air should be fresh, but not necessarily cold, a temperature of 65° being preferable. Gas stoves must be condemned, because of the large oxygen consumption and the possibility of gas leakage.

If more than one sleeping apartment is at the disposal of the patient, he should be carried from one room to another every two or three hours, so that one may be thoroughly aired while the other is being occupied by the patient.

The child should be kept in bed in all severe cases, and in the mild ones for the first few days.

Dietetic.—Whenever possible, fluids should be pushed. In younger infants the diet may be reduced, and in older children the heavier proteid food and all indigestible articles of diet should be avoided. If the digestive tract is not involved, and if the appetite at the end of several days returns, it is inadvisable to restrict the diet too stringently. The importance of maintaining the child's nutrition must not be lost sight of, because we are justified in feeling that a normal resistance thus established tends to an early restoration to health, and also prevents complications.

Baths.—Mothers and nurses frequently are opposed to immersing these patients in water. It is a matter of experience, however, that a warm or hot bath (98° to 100° F.), if given early in the disease, is of benefit. It acts as a diaphoretic, frequently tranquillizes the child, and it has been suggested that it may assist in the elimination of toxins through the skin. It also aids in the reduction of the temperature.

Local Applications.—Continental physicians frequently recommend the use of the moist compress, the so-called Priessnitz application. A towel or a linen cloth, which has been folded, is dipped in water at 70° F., or it is sometimes advisable to have the water 5° F. warmer, especially where the child resents the colder water. The chest is completely enveloped, both front and back, in this compress, which is in turn covered with a dry flannel. These compresses may be changed every two or three hours. They act by reducing temperature, are more or less counterirritant, and, on account of the influence of cool water on the skin, induce deeper respiration.

Poultices of various kinds, cotton jackets, and the paste-like preparations nowadays so commonly employed, have no serious indication, and in young and weakly children often do harm by interference with respiration.

Warm camphorated oil is probably an indifferent remedy, though not infrequently one notices that older children are grateful for its use. Antitussin, well rubbed into the chest, seems at times to diminish the severity of the cough. In a recent paper Rachford has recommended drug inunctions in bronchial affections. The following combination he thinks is efficacious:

℞.	Guaiacol	ʒss to ʒj
	Olei gaultheriæ	ʒj
	Lanolin	℥j

Bisulphate of quinin (ʒj) may be added to this prescription.

Rachford confidently believes that these drugs are absorbed from the skin, and he has shown their presence in the urine.

Inhalations.—In those cases which are characterized by a dry, irritating cough, and where the examination of the chest reveals many dry râles, with little or no secretion, the inhalation of steam seems to give relief. The oil of eucalyptus, turpentine, creasote, compound tincture of benzoin, or spirits of camphor may be added to the boiling water. Prolonged steaming of a room renders it close and stuffy and often tends to make the child uncomfortable. The inhalation should not be employed continuously, but better intermittently. The children need not only moist air, but also fresh air. For this reason it is advisable to carry children frequently from one room to another, as has already been mentioned.

Hot Drinks.—Hot drinks may be given to older children. Heated milk, to which Seltzer or some other carbonated water has been added, frequently allays cough and brings relief.

Medicinal.—The milder cases of tracheobronchitis require little or no medication. As a rule, these children do best if they are kept in bed and given hot baths and hot drinks. In those cases where there is some temperature, several doses of acetyl-salicylic acid (aspirin) certainly render the patients more comfortable and allay restlessness. Similarly, minute doses of one of the coal-tar preparations, preferably phenacetin or antipyrin (½- to 2-grain doses), reduce temperature and quiet cough.

During the early stages of the disease a diaphoretic mixture of citrate of potassium, sweet spirits of niter, with 1- or 2-drop doses of the wine of ipecac, offers a rational though not a specific remedy. For those cases in which there is persistent irritating cough, which wears out the child's strength and prevents sleep, some sedative remedy is usually called for. Sometimes the pharynx, nasopharynx, or larynx is the seat of irritation, and local treatment seems to give relief. The instillation, drop by drop, of an adrenalin solution, 1 : 5000 to 1 : 8000, into the nostrils bathes the nasopharynx and pharynx, and frequently relieves cough. Similarly the yellow liquid vaselin (Cheeseborough's) lubricates the irritated mucous membrane and diminishes coughing. The colorless liquid vaselin is bleached and usually contains free acid, rendering it less valuable as a local application. The laryngeal and tracheal cough is relieved by inhalations and sedatives.

As sedatives, the coal-tar products already referred to sometimes suffice. It must not be forgotten that a certain amount of coughing and expectoration is nature's way of ridding the bronchi of a pathologic secretion. It is only when the cough is excessive that sedatives are called for.

Tincture of belladonna, in 1- or 2-minim doses, acts in some cases as a sedative, and is usually well borne by children, though occasionally after the administration of several doses toxic symptoms are observed. The fluidextract of hyoscyamus, in doses of $\frac{1}{8}$ to $\frac{1}{3}$ of a minim, is preferred by some clinicians, particularly R. Fischl. He says it may be given in relatively large doses and is well borne, and frequently diminishes the cough. Hyoscyamus and belladonna have the advantage that they do not constipate. The tincture of hyoscyamus may be used in doses from 1 to 5 minims.

As a general rule, opium should not be given to children in a routine way, but very often where the cough is harassing nothing remains but to give minute doses of opium in some form or another. The following table from Holt illustrates the dosage of the various preparations of opium:

	1 Month	3 Months	1 Year	5 Years
Paregoric	♏ j	♏ ij	♏ v–x	♏ xxx–xl
Deodorized tincture	♏ $\frac{1}{20}$	♏ $\frac{1}{10}$	♏ $\frac{1}{4}$–$\frac{1}{20}$	♏ ij–iij
Dover's powder	gr. $\frac{1}{20}$	gr. $\frac{1}{10}$	gr. $\frac{1}{4}$–$\frac{1}{2}$	gr. ij–iij
Morphin	gr. $\frac{1}{1000}$	gr. $\frac{1}{600}$	gr. $\frac{1}{200}$	gr. $\frac{1}{30}$–$\frac{1}{20}$
Codein	gr. $\frac{1}{300}$	gr. $\frac{1}{200}$	gr. $\frac{1}{60}$	gr. $\frac{1}{10}$–$\frac{1}{8}$

Heroin hydrochlorate may be given in doses of $\frac{1}{300}$ to $\frac{1}{100}$ of a grain for children from one to three years old.

Of this group of opium derivatives, paregoric and Dover's powder are probably the most frequently used. The Dover's powder is somewhat difficult to administer, on account of its disagreeable bitter taste, but is frequently combined with phenacetin. Paregoric is more readily given and more pleasant to the taste. Morphin is rarely required, and should not be used in children under two years of age, unless it is absolutely necessary.

The administration of opium, whatever the nature of the preparation may be, should be carefully controlled.

Parents and nurses should be warned that opium in some form is being administered, and if it produces drowsiness its use should be discontinued until the child has fully awakened.

As a general rule, it is better not to combine preparations of opium with cough mixtures. It is a far better plan to have this powerful drug put up in the form of powders or in simple solution, so that the frequency of dosage shall be regulated by the reaction of the patient.

The spirits of chloroform (1- or 2-drop doses) is prescribed extensively by English physicians, either alone or in combination with other drugs as a sedative remedy for cough.

Expectorants.—So far as the use of expectorant and emetic drugs is concerned, after a long experience one becomes somewhat skeptical of their real value. It is doubtful whether these drugs shorten the intensity of the cough or diminish the tendency to complications in acute bronchitis. Exceptionally it is true that in certain cases, where symptoms of suffocation are present, an emetic drug pushed to the point of vomiting relieves the tubes of tenacious mucus and breathing becomes less difficult. Frequently vomiting does not occur even after the administration of several doses of the emetic, and one cannot overcome the feeling that the drug which was intended for an emetic is acting as a depressant. Tickling the fauces with a cotton swab is frequently an efficient method of producing emesis, and when this method is successful it fulfils every therapeutic indication.

As an expectorant, the syrup of ipecac may be given in 1- to 5-drop doses, and the wine in ½- to 2-drop doses; as an emetic, dram doses may be given every fifteen minutes until vomiting occurs. Antimony and potassium tartrate (tartar emetic) may be given in doses of $\frac{1}{200}$ to $\frac{1}{100}$ of a grain as an expectorant. It should not be used as an emetic in children. Apomorphin hydrochlorate in doses of $\frac{1}{200}$ to $\frac{1}{400}$ of a grain seems to liquefy the mucus and its administration tends to promote expectoration, but it is powerfully depressant, and emetic doses should be avoided in children.

Ammonium chlorid is a stimulating expectorant and may be given in doses of ¼ grain for each year of the child's age. The syrup of senega (5 to 10 minims) or the fluidextract (1 to 5 minims) may be given as a stimulating expectorant in the last stages of bronchitis. The syrup of squills in 2- to 10-drop doses is an old and frequently used expectorant. The compound syrup of squills, which contains ¾ of a grain of tartar emetic to each half ounce, is too powerful as an emetic and too depressing a preparation to be used in young children.

Cathartics.—The use of cathartic drugs may become necessary if constipation is present. It is customary to give a cathartic drug at the onset of the disease. The persistent use of cathartics without reference to the condition of the bowels is to be deprecated. The traditional feeling that cathartics should be administered to rid the organism of mucus from the bronchial tubes, or to eliminate mucus which has been swallowed, has no foundation in the pathology of this disease. The protracted use of laxative drugs acts as an irritant and predisposes the mucous membrane of the bowel to secondary infection, disorders digestion, and materially interferes with the much to be desired nutrition of the child.

But, after all has been said, it seems important again to emphasize the fact that acute bronchitis is a self-limited disease, that prophylaxis is more important than any attempt to cure, and that no specific plan of treatment is known. In all cases the management is symptomatic and hygienic. A moderate amount of warmth, a well-ventilated room, the reduction of the patient's temperature, the alleviation of distressing cough, and the maintenance of bodily strength and nutrition are the important elements in treatment. In this affection, as in many others which befall infants and young children, over-medication and over-treatment are more productive of harm than good.

CHRONIC BRONCHITIS

Chronic bronchitis may be the result of or may follow an attack of acute bronchitis, or the chronic form may develop insidiously, without any acute, well-marked stage. The difference between the two forms depends less on a variation in symptoms than upon the duration and persistence of the disease. Not infrequently a chronic bronchitis depends upon a congenital or an acquired heart disease. Under these circumstances bronchitis is a manifestation of passive congestion of the lungs.

Tuberculous processes may at times run the course of a chronic bronchitis. In these cases, however, percussion may indicate dullness at the apex, or physical signs give evidence of infiltration in other parts of the lung. In tuberculosis, too, there are febrile manifestations; in many cases the sputum may be obtained for examination, and the various tuberculin skin manifestations may give evidence of tuberculosis.

In children chronic pleurisy with obliteration of the pleural cavity and rachitic malformations of the chest may cause bronchitis, because they alter the circulatory conditions in the lungs. Children with the so-called "exudative diathesis," manifested by eczema, enlarged glands, including enlargement of the pharyngeal tonsils and the thymus gland, may suffer from chronic bronchitis. Furthermore, those suffering from severe anemia, congenital syphilis, rachitis, or chronic kidney disease, or delicate children suffering from more or less malnutrition, are very often subjects of chronic bronchitis.

Sometimes a protracted pertussis is associated with a profuse, persistent bronchitis, and the underlying pertussis fails to be recognized. This is frequently true when whooping-cough is atypical. Or the chronic bronchitis may set in during the last stage of whooping-cough, and may continue for months after the primary disease has disappeared. Similarly, bronchitis may be a manifestation of measles, bronchitis continuing for weeks or months after the measles has subsided.

In chronic bronchitis the process is nearly always diffuse and bilateral. The large and middle-sized tubes are most frequently involved, though the process may extend to the smaller bronchi, giving all the clinical evidence of a fine bronchitis.

In cases of long-continued diffuse bronchitis emphysema is not uncommon and bronchiectasis may occur. In the severest forms dilatation of the right heart and venous congestions of other organs may take place.

The symptoms are practically those already described under acute bronchitis. Cough is the most prominent symptom. The physical signs of emphysema may be elicited in the protracted or more severe cases. In rare cases clubbing of the fingers is noticed. Acute exacerbations sometimes occur, occasionally with slight fever.

Prophylaxis.—Every possible means should be employed to build up these little patients who are subject to bronchitis and cough. The food should be of the most nutritious kind. Such children should have frequent baths followed by cool sponging. The atmosphere should be free from dust, moderately warm, and not too dry. If adenoids give rise to obstruction, or if the pharyngeal tonsils are large, interfering with respiration, their removal is advised as a prophylactic measure.

Climatic Treatment.—Children suffering from chronic bronchitis are often relieved simply by sending them for a season or two to a dry, warm climate, where they may be outdoors. Southern California, Florida, or the resorts in Mississippi, along the Gulf of Mexico, are in much favor during the winter season. One should avoid sending the children too far south on account of the enervating climatic conditions which set in during the early part of April. There seems to be quite a difference of opinion whether these patients do best in the mountains or at the seaside. As a rule, the mountain resorts are too cold during the winter months, though the southern Alleghenies and the southern slope of the Pyrenees and the Alps offer an exception. If possible, an inland resort should be selected, though high elevations should be avoided, especially for the asthmatic cases. The dry, arid regions of Arizona and New Mexico are sometimes beneficial.

Medicinal Treatment.—Creasote in 1- to 3-drop doses is believed to be beneficial to these patients. Cod-liver oil in dram doses, three times a day, is very often the most satisfactory remedy that can be found. In those cases in which the bronchitis is characterized by dryness, the iodid of sodium (1- to 2-grain doses) or the syrup of the iodid of iron (in 1- to 10-drop doses) is frequently administered with advantage. In the dry forms ipecac, apomorphin, and the ammonium preparations may be tried.

Inhalations containing eucalyptus, terpin hydrate, creasote, turpentine, and a variety of similar drugs, sometimes offer relief.

In cases of chronic bronchitis with marked secretion six or eight pieces of blotting-paper, distributed in various parts of the sick-room, are moistened with 2 or 3 drops each of the following mixture:

Menthol,
Eucalyptol .... āā 2.5 (40 minims)
Olei terebinthinæ,
Olei juniperi,
Olei pini pumilis .... āā 5.0 (75 minims)

When the cough is persistent, disturbing the child's sleep, some sedative must be used. Hyoscyamus and belladonna may be used in the following dosage: The tincture of hyoscyamus (1 to 5 minims), the fluidextract of hyoscyamus ($\frac{1}{8}$ to $\frac{1}{3}$ minim), the tincture of belladonna (1 to 10 minims), the powdered extract of belladonna ($\frac{1}{20}$ grain for one year, $\frac{1}{15}$ grain for two years, $\frac{1}{10}$ grain for three years). If these fail to relieve cough, one of the preparations of opium or an opium alkaloid may be tried. (See table on page 268 for opium dosage.)

In all cases of secondary bronchitis the primary condition should be treated. The heart or kidney, if at fault, should receive attention; rachitic children and those suffering from malnutrition should be placed upon proper diet and treatment.

Respiratory Exercises.—Respiratory exercises are sometimes invaluable in the treatment of this form of protracted bronchitis. Exercises in which dumb-bells are used, or Sargent's or Sander's apparatus, increase the dimensions of the chest, thoroughly ventilate the lungs, and help in the general physiologic processes of respiration and circulation primarily, and the up-building processes of the body secondarily. Respiratory exercises are best given, at least at the onset, by one who thoroughly understands their application. Later on the mother or nurse may learn to give them.

The underlying principles of respiratory gymnastics should provide that the patient take deep, regular breaths, about as frequently as normal breathing. Sometimes this may produce coughing, but this is not always unfavorable, as it is accompanied by forcible expiration, assists in the expulsion of mucus, and in turn permits of more easy access of air through the bronchi. These exercises at first may be taken for five minutes three times a day. Of course, it goes without saying that if there is an acute inflammatory process in the lung or pleura, or a hemorrhagic expectoration, or severe pain, the exercises should be omitted. In older patients who are out of bed, deep breathing exercises may be employed. With extension of the arms the patient is instructed to take a deep breath, and with the arms falling toward the body, the patient is instructed to expel the air.

These patients may also ascend stairs or climb hills; the ascent should be very slow, and inspiration and expiration should be timed with the climbing process.

The practical carrying-out of these exercises permits of numerous modifications, a detailed description of which need not be entered into here.

The breathing of compressed air in pneumatic cabinets is no longer in general use, though it is still sometimes recommended.

Posture.—In some cases that are characterized by excessive bronchial secretion some benefit is derived by arranging the posture of the patient so that the head lies at a lower level than the body. This is best accomplished by elevating the foot of the bed and by taking away the pillow entirely, or by using one that is very small.

***x*-Ray Therapy.**—Schilling (Nuremberg), after a large experience, is very enthusiastic about the treatment of bronchial asthma and chronic bronchitis by the use of the Röntgen rays. The expectoration, he says, diminishes and the asthmatic attacks disappear entirely. His most striking results were in children.

BRONCHOPNEUMONIA

Bronchopneumonia is nearly always a secondary disease. It occurs frequently after bronchitis or as a complication of the intestinal infections, or it may be associated with the acute exanthematous diseases, diphtheria or pertussis, or it may occur during the course of typhoid, or any disease of bacterial origin. Frequently it occurs in cachectic infants. On autopsy it is found as a terminal condition of marasmus or some nutritional disorder. Nearly all new-born infants who die of septic infections show bronchopneumonic foci post mortem. In the so-called "grippe" infections, which are manifested by catarrhal symptoms of the upper respiratory tract, bronchopneumonia is not an infrequent complication.

The infective process may descend along the mucous membrane of the bronchial tubes until the finest tubules are involved; extending still further into alveoli, a bronchopneumonic focus is produced. Or the micro-organism may be caught up by the moist mucous surfaces of the nose, mouth, and throat, especially the tonsils, and from these situations may find access to the lymph-vessels, and, following this route, the infecting material may gain entrance to the bronchial glands, the lungs, and the pleura.

The disease is most prevalent among children whose sanitary environments are bad, and among those who have been enfeebled by previous disease, such as rickets, chronic indigestion, syphilis, and tuberculosis. In institutions where large numbers of children are cared for, bronchopneumonia frequently occurs in epidemic form.

Types of Bronchopneumonia.—The physical findings as well as the clinical manifestations of this disease vary within somewhat wide limits. The type of the disease depends upon the extent of the consolidation, the number, size, and distribution of the inflammatory areas. The following varieties are usually described:

1. Acute bronchitis of the small tubes (the so-called capillary bronchitis). In this variety there is no physical sign of consolidation in any part of the lung. Sibilant râles, with coarse and fine crepitant râles, are distributed, as a rule, over both lungs. One lung alone may be involved. The sibilant râles are due to congestion and swelling of the mucous membrane of the larger and smaller tubes. Those areas over which a feeble respiratory murmur is heard may be interpreted as areas of congestion.

2. Small disseminated areas of bronchopneumonia are characterized by small foci of consolidation. These do not give rise to dullness on percussion. As a rule, vocal fremitus is not elicited. On auscultation one hears crepitant râles and exaggerated or bronchovesicular breathing over the disseminated foci.

3. In the third form one has to do with more or less massive areas

of consolidation. The percussion note is dull over a considerable part of a lobe, or even an entire lobe may be involved. Vocal fremitus in these cases is increased and bronchial breathing is elicited on auscultation, and fine, moist, crepitating râles may be heard over the involved lung, though, as a rule, when hepatization is complete tubular breathing alone is heard and the râles disappear from the affected area. The portions of the lung not involved in the pneumonic processes give the signs of bronchitis.

Prophylaxis.—Prophylaxis consists in the early treatment of every case of acute tracheobronchitis, and all catarrhal conditions of the upper respiratory tract, whether primary in origin or complicating some acute infectious disease. If the infant is suffering from a bronchitis, the directions already laid down for the treatment of this disease should be followed. These children should not be taken outdoors, and should be kept in an atmosphere free from dust. If the child is suffering from a nasopharyngitis, careful toilet of the nose should be performed with regularity, which consists of cleansing the nostrils with a warm normal salt solution or a weak adrenalin solution (1 : 10,000 to 1 : 6,000), care being taken not to inject the fluid with any considerable force, lest the infecting material be forced into the middle ear. This may be followed in a half hour to an hour by the instillation of warm liquid vaselin, or a 10 per cent. borated vaselin ointment, or mentholated vaselin (1 grain to the ounce).

Children suffering from bronchopneumonia should be isolated. In hospitals and institutions children attacked with bronchopneumonia should be removed, wherever possible, from crowded wards, and individual prophylaxis should be instituted. Each infant should be provided with its own utensils, such as dishes, thermometer, toilet articles, as brush, comb, soap, washrag, towel, absorbent cotton, powder, vaselin, tongue spatula, and all discharges from the nose and throat should be disinfected, or, what is better, should be collected on cheese-cloth or cotton and burned.

As has already been indicated, infants suffering from rickets, malnutrition, and gastro-intestinal diseases fall an easy prey to bronchopneumonia. For this reason the prevention of these diseases and their speedy and effectual treatment when they have arisen are important factors in the prophylaxis of pulmonary complications. Important, too, is the proper sanitation of the dwelling-rooms. They should be free from dust and from noxious gases. A room into which small quantities of coal-gas are continually escaping is rendered unsafe, threatening the infant with respiratory complications. Rooms which are continuously overheated and which are characterized by extreme dryness predispose infants to respiratory attacks. The temperature of the living-rooms is most acceptable at 65° to 68° F., and during the winter, when the fires are providing warmth, pans of water suitably placed near the stove or radiator should have a place in every nursery.

Those who are suffering from bronchitis should have their position frequently changed in bed, or should be picked up and held or carried, so as to avoid hypostasis and atelectasis.

Treatment.—There is no specific treatment for bronchopneumonia. A specific serum is much to be desired, but so many different microorganisms are capable of producing the disease, and, as a rule, the nature of infection in an individual case is so difficult to establish during the life of the patient, that at present we may feel little encouraged from this line of therapy. All the methods of abortive treatment in the past have failed and the much-vaunted drugs which were employed for this purpose have been abandoned. Clinicians no longer discuss quinin, veratrum viride, or any other drug for the abortive effect.

Open-air Treatment.—There is no more important element in the treatment of bronchopneumonia than fresh air and perfectly ventilated rooms. Sufficient experience has been accumulated to convince the most skeptical that bronchopneumonia treated by providing for an abundance of fresh air is an accepted form of treatment. I believe in this procedure for most cases, though I think it must have its limitations. I cannot join with those enthusiasts who would place any and every baby on the roof of the hospital in zero weather. Common sense, the individual control of the patient, and the unprejudiced interpretation of the reaction to the treatment should govern the physician in the selection of this method. Young and delicate infants bear extreme cold poorly, and, after all, one may rightfully ask what greater benefit will result from a current of cool fresh air which is 50° or 60° F. than from a similar current of air which has a temperature of 20° to zero° F.

Diet.—Infants as well as adults suffer from anorexia during the acute stage of pulmonary disease. Nevertheless, the feeding is of considerable importance. Young infants who are at the breast should be encouraged to draw out the milk. Frequently, however, on account of the dyspnea or the severe prostration, this is impossible. In these cases it is advisable to pump the milk from the breast and to feed it to the infant in small doses with a spoon or medicine-dropper.

In older children milk which has been diluted with an equal part of water, broth, eggs in liquid form, buttermilk, orange juice, particularly if constipation be present, and beef juice, may be tried. Sometimes it is advantageous to peptonize the milk. The proprietary preparations of powdered casein, such as nutrose, plasmon, and others, have distinct nutritive value, if combined with other foods.

In feeding young infants, especially those who refuse food, it has seemed to me better to give small quantities frequently, 2 or 4 ounces every two hours during the day, than to attempt to give larger quantities once in three or four hours.

Hydrotherapy and Antipyretics.—It may be questioned whether it is wise to adopt too strenuous a plan for the reduction of temperature in bronchopneumonia. Certainly the antipyretic drugs have fallen into well-merited disuse. No clinician of reputation would care to be quoted as having given one of the coal-tar drugs continuously throughout an attack of pneumonia.

A moderate temperature of 102° to 103° F. requires no vigorous treatment. It has been suggested that recovery occurs more promptly in cases where a moderate temperature is present than in those characterized by low temperatures. It is thought that in the cases produced by pneumococci the occurrence of crisis or even an early lysis is intimately associated with salt metabolism, particularly the retention of sodium chlorid. In patients who eliminate considerable sodium chlorid through the urine and run a low temperature, it is found that the termination is delayed and the prognosis rendered unfavorable.

Where the temperature is excessively and persistently high,—103° to 105° F.,—especially where there are symptoms of nervousness and restlessness, warm baths (temperature 88° to 90° F.) are indicated. The patient should be allowed to remain in the bath not longer than five minutes, as a rule. If during the bath cyanosis or weakness should occur, baths are contraindicated and the child should be at once removed. The use of cold baths presents no advantages. Indeed, my own experience is that they cause actual suffering to these little patients, produce shock, if not collapse, and I believe their employment should be abandoned in infants and young children.

Priessnitz's application (see Bronchitis) is a very useful hydrotherapeutic plan and is particularly well adapted in the treatment of bronchopneumonia.

Sponging the body with tepid water and alcohol will sometimes reduce the temperature and quiet the patient. An ice-bag may be applied to the head, though in young infants it is somewhat difficult to keep the ice-bag in position.

Drug Treatment.—*Sedatives.*—It is only rarely that a sedative drug is required for cough or pain. Occasionally Dover's powder or paregoric in minute doses may be needed, though in young infants and children these remedies are used with caution, and as a matter of actual experience are seldom employed.

Expectorants.—The expectorant drugs are of doubtful value. Their use in debilitated or weak children is fraught with danger. Occasionally, where the bronchi seem filled with tenacious mucus, small doses of ipecac or tartar emetic may be indicated. (See Bronchitis.)

Stimulants.—In the severe cases it is frequently necessary to resort to cardiac stimulants. For this purpose aromatic spirits of ammonia in 3- or 5-drop doses, well diluted in water, may be given every hour or two for a child of one year. It is less objectionable than the other ammonia preparations, inasmuch as it is less liable to provoke symptoms of indigestion. Strychnin may be used if stimulation is indicated. It should not be employed in a routine way, and should be administered only when cardiac support is required. A child one year of age may be given $\frac{1}{300}$ of a grain, repeated in three hours, if necessary.

None of the stimulants employed can surpass camphor injections. Young infants may be given 10 minims of a 10 per cent. camphorated oil, hypodermatically, repeated every hour or two, if necessary. In desperate cases no other form of cardiac stimulation seems quite as efficient.

Digitalis, strophanthus, and caffein may be used if occasion demands. Jacobi advises a combination of infusion of digitalis with nitroglycerin. The infusion may be given in one-half to one teaspoonful doses, and the nitroglycerin in doses of from $\frac{1}{500}$ to $\frac{1}{100}$ of a grain. The nitroglycerin seems to give relief when there is extreme cyanosis and dyspnea.

Tincture of belladonna in 1- to 2-drop doses has been warmly recommended and is particularly indicated where there is considerable bronchitis and dyspnea. Toxic symptoms of the drug, such as delirium and flushing, should be looked for, and on their occurrence the remedy should be stopped at once.

Alcohol is a valuable remedy. It has been my own custom to begin early in the disease with alcoholic stimulation. Its abuse rather than its use calls for condemnation. Excessively large doses should be avoided. Fifteen to 20 drops of whisky or brandy may be given to an infant under a year old, and 20 to 40 drops may be given to a child from one to five years old, every two or three hours.

Oxygen inhalation is valuable when cyanosis, dyspnea, and great prostration occur. The oxygen should be looked upon as a stimulant and should be considered a temporary expedient to tide a patient over a critical period.

Cathartics.—The protracted or daily use of cathartics is to be condemned. It is irrational to expect any good to result from a daily dose of any laxative drug. Whatever the nature of this medication, I am convinced that sooner or later it ceases to be cathartic and becomes irritant. An occasional dose of castor oil, or even of calomel, is permissible. For the most part, however, these patients receive the greatest benefit from a rectal injection, or if the tympany is embarrassing respiration, by the passage of a rectal tube or catheter.

Inhalations.—Inhalations of steam are not indicated in bronchopneumonia; much less the steam tent. They vitiate the atmosphere, interfere with the ventilation, and in general are not compatible with open windows and fresh air.

External Applications.—Of all of the external applications which have been in vogue, mustard paste, bath, or compress deserve greatest consideration (except the Priessnitz application, already referred to). Heubner is a warm advocate of the mustard compress. He believes that it produces a hyperemia of the skin and relieves the vascular congestion of the lungs. He thinks that the hyperemia of the skin acts like venesection. In this way the right heart is relieved and the congestion of the lung diminishes. He is convinced that he has seen critical cases much benefited. Dyspnea is relieved, respiration becomes freer, cough is diminished, and the râles are less pronounced. His plan of procedure is as follows: To a quart of hot water he adds two handfuls of mustard, and this is well stirred until it forms a smooth mixture. A muslin or flannel cloth, sufficiently large completely to envelop the child to the neck, is dipped into the mustard solution and wrung out. Over this a woolen or flannel cloth is applied and the child allowed to remain enveloped for twenty minutes. At the end of this time he grows restless, and feels the irritation to the skin. He is now taken out of the mustard application and a compress, which has been dipped in warm water, is substituted for the mustard. The infant is allowed to remain in this latter compress two or three hours, until active perspiration occurs. After the perspiration has occurred, the patient is placed for a short time in a tepid bath, given a cool shower, and returned to bed. He should be allowed to remain undisturbed for half a day. This application should not be repeated oftener than once in twenty-four hours.

Baginski has suggested venesection in desperate cases. This form of treatment is too heroic to gain adherents. In severe cases collapse and prostration are already at hand, and venesection would turn the tide against the patient.

In protracted cases where the process exists for weeks and months general supporting treatment should be prescribed. The diet should be carefully supervised and hygienic surroundings provided for. Whenever possible, these patients should be kept outdoors. They should be removed to a warm, dry climate. Cod-liver oil, arsenic, and iron should be employed for their tonic effect.

LOBAR PNEUMONIA

Lobar pneumonia is a frequent disease of infancy and childhood. As in adults, the disease usually attacks one lung, and in the majority of cases selects one of the lower lobes. It was formerly a popular belief that lobar pneumonia was of rare occurrence in infancy and childhood, but all clinicians are agreed that after the ninth month of life lobar pneumonia is of as frequent occurrence as in adults.

The etiology of lobar pneumonia is similar to that already described for bronchopneumonia. The pneumococcus is most commonly the active micro-organism. In the severe cases, particularly those which are fatal, the pneumococcus is found circulating in the blood. The bacillus of Friedländer, streptococcus and staphylococcus, the typhoid bacillus, and the influenza bacillus are less commonly the cause.

Lobar pneumonia is characterized by sudden onset. Sometimes there is a sense of chilliness; most frequently vomiting occurs as an initial symptom. In those children who are old enough to localize pain, the affected lung is much complained of. The pain is often referred to the abdomen, and appendicitis or peritonitis is frequently suspected during the first days of the attack. Fever occurs early in the disease and is usually high. Fever of 104° to 107° F. is not of infrequent occurrence. Lobar pneumonia in childhood is sometimes preceded by an attack of acute bronchitis, which may gradually merge into a pneumonia, almost unnoticed. Lobar pneumonia tends to terminate by crisis in from five to fifteen days. It is the general rule in pneumonia that infants and young children do not expectorate or raise sputum, that the mortality rate is exceedingly low, that the toxemia is, as a rule, considerably less than in adults, and that the patient shows less tendency to cardiac failure than in later life.

Complications.—In view of the fact that the pneumococcus gains access to the blood-stream, it is to be wondered at that complications are not more frequent. Otitis, meningitis and encephalitis, arthritis, osteomyelitis, pericarditis, peritonitis, and purulent pleurisy are the most common complications.

The treatment of lobar pneumonia is for the most part identical with that of bronchopneumonia, already described. What has been said of the prophylaxis of bronchopneumonia applies with equal force for lobar pneumonia.

The open-air treatment, under proper limitations, is applicable in both forms of the disease.

It would be but a repetition if one were to lay down a diet for lobar pneumonia.

The hydrotherapy is applicable in both disorders, though it is true that in lobar pneumonia the temperature may reach a very high point, while the duration of the fever is comparatively short. But even under these circumstances it is not advisable to exhaust the patient by too frequent immersion in water, and certainly not by the administration of antipyretic drugs. Tepid sponging, compresses applied to the chest, or an ice-bag to the head is usually all that is required for the treatment of the fever.

Certain it is that we have no specific treatment for pneumonia, and it is a sad commentary that many pneumonia patients suffer more from too much than from too little treatment. The external applications of pastes and plasters, the excessive administration of cathartics, the uncalled-for use of powerful stimulants and emetics, tend rather to diminish the resistance than to combat the disease or to shorten its course.

It is a well-recognized fact that lobar pneumonia of infancy and childhood is a self-limited disease, and that unless special indications arise no active medicinal treatment is required.

I would not be understood as saying that most careful medical supervision is not desirable, nor that the most intelligent nursing could well be dispensed with, nor that drugs should not be administered if indicated. Without any special line of treatment the mortality of lobar pneumonia in children is less than 5 per cent.

The drugs most frequently required in the treatment of lobar pneumonia are the stimulants. In those cases where the heart action becomes weak and rapid, the use of the ammonium preparations, such as the aromatic spirits, in 5- to 10-drop doses, may be repeated every hour or two, or the carbonate of ammonia in 1-grain doses, the taste of which should be disguised by a syrup. In extreme cases the tincture of digitalis in 1- to 3-drop doses, for a child under six years of age, or the hypodermatic injection of camphorated oil (10 per cent.) in doses of 5 to 10 drops, may be repeated at intervals of one to two hours. If cyanosis occurs, with dilatation of the right heart, strychnin used hypodermatically in doses of $\frac{1}{300}$ to $\frac{1}{150}$ of a grain, and repeated cautiously, seems sometimes to tide a patient over a critical period.

Those cases which seem to go into a collapse during the precritical period are benefited by hypodermatic injection of strychnin or the inhalation of oxygen.

Older children complain of pain over the chest. This is sometimes relieved by strapping, or by the use of warm moist poultices or compresses, and the internal use of opium in some form. For this purpose paregoric in 3- to 10-drop doses, or Dover's powder in ⅛- to ¼-grain doses, repeated at short intervals, gives relief without producing any unfavorable results.

As a rule, the cough is not troublesome during the height of the disease, though occasionally it is harassing, and for its alleviation bromids or opium preparations in minute doses may be employed.

Among the complications encountered, otitis media is very common. It may or may not give rise to pain, but otitis is a frequent cause of hyperpyrexia and delirium. Undoubtedly, some of the cases of cerebral pneumonia which have been described, with manifest meningeal symptoms, have greatly improved if the membrana tympani has been punctured or has ruptured spontaneously. In every case where the course of the fever is protracted, the patient should be carefully inspected, and, if an otitis is discovered, appropriate treatment should be begun, namely, paracentesis of the membrane, or, in cases where there is no bulging and little or no fluid has formed in the tympanic cavity, hot irrigations, the use of external heat, and the instillation of a few drops of 5 or 10 per cent. carbolic glycerin solution into the auditory canal.

Among the complications which call for special consideration in the matter of treatment may be mentioned hyperpyrexia, endocarditis, pericarditis, peritonitis, meningo-encephalitis, acute nephritis, delayed resolution, and abscess of the lung. Symptoms of myocardial involvement may be present during convalescence.

For the arthritis which sometimes occurs, no special form of treatment can be recommended. The effusion is frequently purulent. Its nature should be ascertained by the aspirating syringe. Purulent effusions require surgical procedure and drainage; serous effusions require that the joint be immobilized and external heat applied. In older children an ice-bag may be used.

After the temperature has fallen to normal, it is well to keep the patient in bed for a few days. If the heart action shows no irregularity and no further complications have occurred, the patient may be permitted to leave the bed at the end of this time. He should be liberally fed and given tonic preparations during the convalescence. The older and more active children should not be permitted to over-exercise during the first few days of the convalescence on account of heart strain. Nor should such a child be sent to school until several weeks have elapsed. I have more than once had the unfortunate experience of seeing a child recover from a pneumonia and in a few weeks succumb to an attack of diphtheria or scarlet fever.

During the cold winter months it is advantageous to send a convalescing pneumonia patient to a warm climate.

Cases characterized by delayed resolution or protracted convalescence should receive liberal food, tonic treatment of iron, arsenic, cod-liver oil, and, if possible, should be removed to a temperate climate, where they can be kept for the most part outdoors.

PLEURISY

Dry pleurisy (pleuritis sicca) occurs in children as in adults, frequently associated with lobar pneumonia. The lung may be covered with a few fibrinous adhesions, or a thick, yellowish-green layer may be deposited. In tuberculous pleurisy gray or yellow tubercles, of varying size, may give rise to a moderate exudation over the pleural surfaces. The exudation is greatest in the pneumococcus infection.

In mild cases of dry pleurisy the course is short, lasting only a few days to a week, though some adhesions generally remain. In the severe cases, with a large amount of fibrinous deposit, the pleural cavity may become obliterated and the lung fixed to the chest-wall.

The serous or serofibrinous exudate is less common in children than in adults. It is frequently diagnosed or suspected when in reality there is an inflammation of the lower lobe of the lung. A serous or serofibrinous pleurisy can only be diagnosed if there be considerable exudate in the pleural cavity, if the heart or liver is displaced, if there is a difference in size of the two sides of the chest, if the vocal fremitus as elicited by crying is diminished, and if upon percussion the resistance as appreciated by the fingers is much increased. In left-sided pleurisy Traube's space is dull on percussion. On auscultation one sometimes hears a friction rub, especially at the very beginning of the disease. This may be heard over the dull portion of the chest or at the boundary of the fluid. One expects to hear diminished breathing over the exudate, though not infrequently in the pleurisy of infancy and childhood the lung is compressed, and consequently bronchial breathing may be heard over a considerable column of fluid contained in the pleural cavity.

Fluid exudate into the chest cavity may occur after a variety of diseases. It may be observed after pneumonia, measles, whooping-cough, rheumatism, scarlet fever, typhoid fever, diphtheria, influenza, pyemic infection, such as sepsis, osteomyelitis, appendicitis, or tuberculosis.

Pleurisy may begin suddenly like a pneumonia, though, as a rule, the onset is not marked by such severe symptoms. Most frequently the disease begins gradually, with moderate fever, painful cough, prostration, and anorexia, though when the fluid has accumulated the pain diminishes.

Tuberculous pleurisy of infants and children has an insidious onset. Children gradually lose their appetite, become quiet and somewhat depressed, and have more or less cough. Pain, fever, and increased frequency of respiration develop slowly. It is noteworthy that the development of tuberculous pleurisy extends over a longer period of time than the non-tuberculous variety. More or less extensive tuberculous processes in some other part of the body usually precede a tuberculous pleurisy. The exudate of a tuberculous pleurisy may be serofibrinous, purulent, or hemorrhagic. In all cases of pleuritic effusion, when doubt exists as to the character of the fluid, exploratory aspiration is indicated. This procedure, if done with ordinary care, is devoid of harm. The puncture should be made with a needle sufficiently large to aspirate thick pus. It should not be too long and should not be buried too deeply in the thoracic cavity. It should first be tested with sterile water to ascertain if it is in good working order. It is needless to say that asepsis should be practised. The skin should be carefully cleansed and painted with tincture of iodin. If the fluid be serous, it will be found in most cases that spontaneous resorption and complete recovery take place. In young infants pleurisy is not infrequently encountered as a terminal condition of sepsis. In these cases the effusion is nearly always purulent.

If the presence of the pleuritic affection be demonstrated, the treatment will depend on the nature of the exudate. If the condition be one of dry pleurisy, one feels assured that the process is, as a rule, short and self-limited, and tends to subside with the disappearance of the primary affection. The patient is put to bed, preferably on a milk diet, and for the relief of pain fomentations may be applied or the chest may be strapped with strips of adhesive plaster. If the cough is severe, or if it gives rise to sharp pleuritic pain, some narcotic drug is indicated. Minute doses of codein or Dover's powder may be used. In the severest pain morphin is called for, and sometimes nothing less than a hypodermatic injection of $\frac{1}{20}$ to $\frac{1}{12}$ of a grain for a child of six years, and $\frac{1}{100}$ to $\frac{1}{60}$ of a grain for a child of one year, will give the required relief.

If serous exudate occurs, an attempt may be made to produce elimination through the skin. To induce perspiration the patient is packed in a compress which has been dipped in water (from 90° to 95° F.), the compress to surround the chest, extending from axillæ to navel. This compress is covered with a flannel. The patient is well covered in bed and given hot drinks. When profuse sweating occurs, usually in from one-half to one hour, the compress is removed. This form of treatment is resorted to once daily, and should be continued for three or four days. Perspiration may also be induced by the action of sodium salicylate or aspirin (acetyl-salicylic acid). For a child from six to eight years, 16 to 20 grains of aspirin may be given in the course of twenty-four hours. The salicylic acid preparations are also useful because occasionally the pleurisy is of rheumatic origin, and these drugs tend to limit the extension of the rheumatic process on the pleural surface. Incidentally, the salicylic acid preparations reduce temperature, relieve pain, and add to the patient's comfort.

Diuretic Measures.—Diuretic drugs may aid slightly in the diminution of the quantity of fluid. But, in spite of their use, the effusion is slow to recede. Diuretin, potassium acetate, squills, juniper berries, and digitalis have been advised. Referring to my own cases, I am compelled to say that I have never seen any striking results from diuretics.

Laxative Measures.—The use of laxative drugs to produce elimination from the bowel is of doubtful value. For the method to be at all effectual it is necessary to produce profuse watery evacuations. This is not devoid of danger, because it may lead to severe gastro-intestinal irritation and inflammation.

Diet.—A salt-free diet, such as is employed in the treatment of nephritis, has been advised. Some writers are much impressed with this form of treatment and suggest its use in all cases. Restriction of liquids is recommended. A dry diet is substituted wherever possible, though the fluids cannot be altogether withheld. The quantity permitted to a patient should be somewhat less than the amount of urine eliminated.

While these methods of treatment are referred to, no brilliant results should be expected from their use.

Dyspnea or severe bronchitis of the opposite lung may require the removal of the fluid from the pleural cavity. Sometimes the fluid accumulates very rapidly and causes displacement of the internal organs, particularly the heart and the liver. In such cases removal of the fluid may become necessary. If the exudate has remained in the pleural cavity for three or four weeks, without showing any tendency to diminish, or if the patient is losing in weight and shows a hectic temperature, aspiration should be performed. Forchheimer is inclined to advocate the early removal of fluid; he believes that in this way adhesions are prevented, and thus bronchiectasis, chronic pneumonia, and deformities of the chest are avoided. It may be repeated at this point that the aspiration of the chest for serous pleurisy is not often necessary in infancy and childhood.

Technic of Removing Fluid.—A trocar or aspirator may be used. By percussion the lowest margin of the fluid should be determined, and a point should be selected which corresponds to the lowest level of the exudate. The seventh intercostal space on a line with the angle of the scapula is the safest point for inserting the needle. Various accidents may occur; cases of hemorrhage have been reported; sudden death has occurred, possibly from injury to the heart or great vessels, or because the fluid was too rapidly withdrawn; in some cases it has been suspected that it was due to status lymphaticus.

If anemia, syncope, or collapse occurs, the needle should be at once withdrawn and the opening sealed. The patient should be placed in the recumbent position in bed; the foot of the bed may be elevated.

A siphon may be constructed very simply, which in some respects is preferable to an aspirator. The method described by Cautley is as follows:

Rubber tubing is attached to the canula and trocar. A test-tube is tied to the free end of the tubing. Both test-tube and rubber tube are filled with sterile water or salt solution and clamps put on. The trocar and canula are plunged into the chest and the trocar is removed; the clamps are taken off and the siphon action is at once set up. The overflow is allowed to run into a basin and the pressure is regulated by raising and lowering the test-tube.

Several observers report that after one or two syringefuls of fluid have been removed a rapid improvement, with disappearance of fluid, has taken place.

Cases which are characterized by severe anemia and great bodily weakness suggest the possibility of a tuberculous process. Such cases should be kept in bed and fed liberally during the acute disease, and if circumstances permit, the patient should be sent to the sea-coast or mountains during convalescence.

Empyema.—If the presence of pus in the pleural cavity has been demonstrated, its removal is indicated. One sometimes falls into error by aspirating a small quantity of turbid fluid, thereby immediately arriving at the diagnosis of empyema. It is not uncommon during a subacute or chronic pneumonia to find a small quantity of fluid in the pleural cavity. I have seen a pleural cavity opened at the point of such a puncture, to find that the cavity contained little fluid, but the lung was consolidated. One should not advise operation unless considerable pus is drawn into the syringe. Young infants seem to show less resistance to purulent effusions into the thoracic cavity than older children. This is due to the fact that either their antibodies are less developed, or the infection and toxemia are less likely to remain localized, or possibly that the general resistance of the infant to infection is less developed. Consequently, in young infants who are much debilitated aspiration or siphonage may be resorted to as a preliminary method, and later operation by incision should be performed.

On the other hand, if the patient shows good nutrition and normal resistance, no time should be lost in removing the fluid. The description of the technic of the operation is found in all surgical text-books. The main facts only need be referred to.

The operation should be performed under local anesthesia. If the affection be bilateral, general anesthesia is more dangerous. Excision of the rib is rarely necessary. An incision between the intercostal spaces and the introduction of a drainage-tube is all that is required. In not a few of the cases after several weeks of drainage complete recovery is obtained. In many cases the patients' and surgeons' troubles only begin after the operation has been performed. Fever persists and emaciation is rapid and extreme. This may be due to a variety of causes. The drainage may be insufficient or there may be encapsulated collections of pus which are not being drained through the incision, or at other times a purulent pericarditis is running an insidious course without physical findings, or possibly a protracted pneumonia or one or more abscesses in the cortex of the lung are baffling the skill of the physician or surgeon who attempts to determine the cause. Occasionally a metastatic abscess or a general septicemia will produce an irregular or septic type of fever. Retained drainage-tubes in the pleural cavity frequently have been the cause of persistent temperature and have prevented the complete recovery of the patient. Irrigation of the pleural cavity is not in general use. Most surgeons depend on simple drainage.

During convalescence attempts should be made to re-expand the lung by gymnastic and respiratory exercise. The patient may be taught to blow soap-bubbles, or to blow fluids from one bottle to another, or to play a small musical wind instrument. Exercise with dumb-bells or Swedish movements, or any other form of exercise which will develop thoracic muscles and produce forced breathing, so as to inflate the lungs, will prevent deformity and pleuritic adhesions.

DISEASES OF THE DIGESTIVE SYSTEM

GENERAL HYGIENE OF THE MOUTH AND DISORDERS OF THE TEETH AND GUMS

(Including Cancrum Oris and Ludwig's Angina)

By M. H. Cryer, M.D., D.D.S.

The mouth, if we consider its various offices, commands attention by its importance. Under normal conditions it is the gateway through which all food for the nourishment of the body enters. It is the seat of the organs of taste, and the workshop wherein are carried on the functions of mastication and insalivation, and the preparation of the food for its reception by the digestive apparatus. It is withal the portal through which not a little of the air received into the lungs is inspired.

If now we add a consideration of its intimate anatomic, physiologic, and therefore pathologic relations, through its nervous connections, with other portions of the alimentary canal, with the organs of sight and smell, and only less intimately with those of hearing, the mouth at once acquires an interest and its care assumes an importance second to those of no other area of the body. Indeed, it is doubtful if it is not supreme in importance. It is not a wild conjecture that had every one an absolutely clean and otherwise a normal mouth, many of the diseases to which human flesh is now heir would disappear.

It is certain that the frequency of the mouth's agency in the production of diseases is almost altogether overlooked, and that its importance in diagnosis is only just beginning to be recognized. How often do we find pathologic conditions in which the most minute examination of the blood and urine is made, the temperature, the pulse, the respiration, and other conditions carefully noted, while the diseased mouth, reeking with dangerous micro-organisms, is overlooked as having no bearing on the case. How often are obstinate cases of impaired vision, hearing, and nervous phenomena treated for months without a suspicion that the trouble may be reflex from diseased or impacted teeth. The nervous relations of the mouth with the cranial nerves through the fifth pair and the various sympathetic ganglia of the head and neck make it a factor always to be reckoned with. Whenever any of these are irritated or inflamed, the disturbing element may be found in the mouth, whence the disturbance may be communicated through them to any of the organs of special sense or distributed to far distant regions.

Bacterial Infection.—Again, the bacteria which are recognized as the active agents in the causation of many diseases are mostly received into the body through the mouth. Is not the mouth a patent central propagating-place for many varieties which, once received, are multiplied enormously? And what is their natural destination after their reception into the mouth but the various organs of the body, there to do their work of destruction unless rendered inert or innocuous?

That the danger of bacterial infection from the mouth is real is shown by the investigations of Miller, Biondi, Kreibohm, Arkovy, Gallippe, Vignal, Black, and others, who have clearly demonstrated the existence in the mouth of a large variety of pathogenic bacteria, some of which are present under almost all circumstances.

William Hunter, of London, has prominently recognized the relation of mouth bacteria to certain diseased conditions, and has contributed valuable observations upon "oral sepsis," noting toxic neuritis, septic gastritis, and other septic conditions as due to infection from the mouth.

When the mouth is studied from a bacteriologic standpoint, we find an appalling list of enemies to health ready to seize upon any point of vantage. Fortunately, the destructiveness of the majority of these is negatived or destroyed by certain neutralizing agencies found in the secretions of the mouth and alimentary tract, when in normal condition. But when a diseased condition of these or of the general system exists, the power of the beneficent agencies is weakened and the virulence of the toxic micro-organisms may be correspondingly increased. Under such conditions the constantly increasing number of these pathogenic organisms will eventually overcome the natural resistance of the mouth and other portions of the alimentary canal. It is therefore apparent that while the maintenance of the mouth in an aseptic condition is desirable at all times, to strengthen the natural resources for destruction of injurious bacteria, hygienic treatment of the mouth becomes absolutely a necessity whenever disease is present.

The Necessity of Cleanliness.—The care of the mouth, when the paramount importance of its cleanliness is considered, is not an onerous task in health, provided all the conditions are favorable. Perfect cleanliness, indeed, implies the presence of sound teeth, in correct alignment, and surrounded by gum tissue which is free from disease. Thorough disinfection of the mouth under such conditions is easy. The mouth which has always been kept clean, which has, as it were, become habituated to a condition of cleanness, is easier to care for than one which has been neglected. Such a mouth is armed at all times against the invasion of deleterious micro-organisms. They enter at once into an antagonistic environment, to which they are almost sure to fall victims, and so lose their noxious potentiality for evil, and are passed on inactive, inert, and harmless.

On the other hand, it is difficult, if not impossible, to keep clean a mouth in which there are decayed teeth with unfilled cavities, teeth badly out of alignment, with abscesses or concretions upon the roots causing disease of the gums. This even when the general health is good, although it is clear that the general health cannot be at its highest mark when such conditions prevail in this important center. The difficulties are vastly increased when the vital resistance of the system is lowered by morbid influences, which mean malnutrition, and accompanying disturbances of the secreting glands of the oral cavity.

As an example may be cited the case of irregularly aligned teeth. The malposed teeth afford niduses where food particles collect, and within these micro-organisms find a refuge for their rapid multiplication. Such mouths are unhygienic and therefore difficult to keep clean under the most favorable circumstances, greatly complicating the task of eradicating disease when once set up.

There is urgent need, therefore, that the mouth be placed in a hygienic condition early, and that it be kept so through life.

From Birth to Time of First Dentition.—The beginning of extrauterine life is the time to begin the care of the mouth. If the child be born with a normally shaped mouth, it is usually an easy matter to keep it in a hygienic condition until the eruption of the deciduous teeth. When giving the daily bath, the nurse should wash the entire mouth with the finger covered with a piece of gauze, after which the gums should be gently massaged with the finger. This course should be continued until the child is old enough to be taught the use of the toothbrush, and this should be examined very carefully to see that there are no loose bristles to give trouble by becoming lodged in or near the glottis. The principal difficulties to contend with at this period are usually of a constitutional nature, such as disorders of nutrition, the treatment of which naturally falls within the province of the medical practitioner.

It should also be a part of the duty of the medical attendant and of those who have the personal care of the child after birth to see that every foreign substance is kept from the mouth, even rubber nipples, except when taking nourishment, or anything which might induce a habit of keeping the jaws apart. The jaws are molded and expanded in embryonic and extrauterine life by contact with each other. When they are apart the action of various muscles tends to draw them inward. The hyoid group has a tendency to draw the mandible in at the angle. The palato-glossus and other muscles of this region also draw inward the tuberosities of the maxillæ, and the facial muscles are prone to act in a similar manner. Sucking the thumb or a false nipple puts into action the muscles connected with the orbicularis oris, which, acting in concert with the palato-glossus, operate to contract the arches.

Should the child be born with a cleft palate and harelip, the malformation should be corrected by surgical treatment as soon as the infant shall have become accustomed to its new environment. At birth the jaw is plastic, and its halves can be more easily forced together than at a later period. The harelip should receive attention immediately after the union of the palatal process and soft palate has been secured. These operations are necessary, as otherwise the mouth could not be kept in a hygienic condition. With the palate open, portions of the secretions of the nasal chamber and associated pneumatic sinuses would become inspissated or incrusted on the walls of the nasal chamber and the roof of the nasopharynx. This deposit would produce an inflammatory condition of the surrounding areas, the products from which would naturally fall into the mouth and so carry infective possibilities into the alimentary canal or respiratory passages. Thorough mastication would be impossible and other physiologic functions would be interfered with.

During the Eruption of the Deciduous Teeth.—The eruption of the deciduous teeth usually begins between the fifth and eighth months,—occasionally earlier, sometimes later,—and terminates at the age of from two to two and one-half years. The oncoming of the teeth is often heralded and accompanied by various disturbances, as fretfulness during sleep, increased flow of saliva, followed by dryness of the mouth, flushed cheeks, and high temperature. The gum over the erupting tooth or teeth becomes tumefied, tense, and shiny, rising a little above the surrounding tissue; digestion may also be interfered with, diarrhea or constipation may occur, and occasionally, in severe cases of difficult dentition, convulsive spasms. Concomitant with the eruption of the teeth various other changes take place in the alimentary apparatus. The development and growth of the salivary and mucous glands of the mouth are in progress, and the stomach is being prepared for the reception and digestion of solid foods. Changes occur also at this period in the intestinal tract. Consequently it would be an error to refer discriminately to one single cause the general pathologic conditions which occur. All the possibilities should be considered and treatment should be directed as seems necessary.

If the child is normally developed and has been fed in the natural way, and no constitutional vice or other trouble exists, the teeth are likely to erupt in a physiologic manner. But as many children are artificially fed and are affected by constitutional and other disturbances, there is generally more or less trouble during the eruptive period. The immediate cause of the pathologic conditions arising during the eruption of the deciduous teeth, when the disturbance is surely referable to the eruptive process, is that the overlying gum tissue has not become resorbed, but has become harder and denser than normal, thus preventing the teeth from "cutting" through; in other words, they are not liberated, but become temporarily impacted. The roots naturally elongate by development and growth, and unless a corresponding resorption of the overlying tissue occurs, the tooth is held down, and the sharp wide-open edges of the root are pressed back upon the soft tissues, where they come in contact with the fifth cranial nerve. The backward pressure of the root-ends against the nerve tissue, which is thus forced against the bone of the jaw, causes discomfort, and through reflex action the general system is more or less deranged.

There is but one remedy for this condition, *i. e.*, the liberation of the teeth by cutting the overlying gum tissue which is holding them down upon the nerve filaments. Many oppose the practice of lancing the gums in such cases, but there is no objection from those who thoroughly understand the anatomy, physiology, and pathology of these parts, and who are familiar with the subject. The writer has often seen children who had had one convulsion after another given immediate relief by judicious and thorough cutting—not mere lancing or scoring. In severe cases almost the moment the pressure is removed from the overlying nerves by the cutting, the child will generally fall into a natural sleep, and if there be no other complications will be up and ready to play within a few hours.

In the embryo of normal and healthy parents, as an almost universal rule, the jaws are in typical relation with one another. As no muscular action is required and no antagonistic influence is exerted, the germs of the deciduous teeth usually develop normally. When the parturition is normal, they continue along the same lines, until eruption, which usually takes place in such a manner that the teeth will be found in typical alignment and occlusion, with typically formed arches. Pathologic systemic conditions, by themselves, would appear to have insufficient influence upon the deciduous teeth and the jaws at this period to cause them to assume other than regular positions. The initial impulse toward typical anatomy is seemingly strong enough to carry them through the teething period with only rare or slight departures from the normal. From this time on, however, disturbing pathologic conditions, unless their effects be counteracted, exert an enormous influence in the way of structural alterations of the permanent teeth, in their misplacement, and in modifying the shape of the jaws. Examples of these disturbing factors are hereditary syphilis, scarlet fever, smallpox, and other diseases which leave their impress upon the dermoid tissues and its appendages. The anatomic features of the face, the maxillary sinus, the nasal chamber, and its pneumatic sinuses, the orbits, etc., are also modified in form, through these influences, thus interfering with the organs of mastication, speech, breathing, olfaction, sight, and even hearing. In order to avoid the results of these disturbances the deciduous teeth should receive unremitting care, to the end that decay be not allowed to progress in such a manner that their pulps become exposed or lost before the physiologic time for the teeth to be "shed." The premature loss of a single one of these may cause the disarrangement of all of the permanent teeth and modify the internal anatomy of the face. Inflammatory conditions in or about the deciduous teeth may prevent a normal development of the alveolar process and of the jaws proper. For these reasons the care of the deciduous teeth and the mouth during the period of the eruption of the permanent set should be in the hands of a dentist who understands the importance of preventing the loss of the deciduous teeth before the proper time.

The formation of the habit of exclusive mouth-breathing should be guarded against. If a tendency in this direction is observed, the cause should be sought out. Frequently it is mere habit; often it is caused by obstructions of the nasal respiratory tract, as adenoids or bony growths, which latter are sometimes congenital. When such obstructions exist, they should be removed at once. The object in so strenuously insisting upon the care of the mouth at this period of life is to secure the proper alignment and occlusion of the permanent teeth. This cannot be hoped for when any such untoward conditions prevail, and should the teeth erupt irregularly, it would be useless to attempt their regulation until the pathologic conditions of the nose and throat are corrected, as permanent results could not be expected.

If during the first six years of the child's life it should have been so unfortunate as to suffer from any of these disturbing influences, either surgical or medicinal treatment will be necessary, in kind and in proportion to the injury.

During the Eruption of the Permanent Teeth.—Assuming that respiration has been carried on through its normal channel, that no undue muscular action has affected the bones of the face, that the deciduous teeth have been properly cared for, that no constitutional disturbances have left their impress upon the developing permanent teeth, the hygiene of the mouth during the time of eruption of the permanent teeth would be comparatively easy. The deciduous teeth will usually be "shed" at the proper time to allow the twenty anterior permanent teeth to take their places, and the twelve molar teeth which have no predecessors will erupt into their normal positions in due time. The deciduous teeth should, however, be extracted if they show a tendency to remain too long in position, thus preventing their permanent successors from erupting or causing them to be carried into false positions. If the permanent teeth are inclined, for any reason, to take false positions, they should be assisted into place by the use of the simplest appliance that will accomplish the object. Decay should be looked for, and when found proper means to remove it and prevent its extending should be adopted. If it should extend until the pulp becomes irritated, the child will have toothache and the treatment becomes more difficult. If allowed to go on until the pulp becomes "exposed," infection will be communicated to the soft tissue. This will result not only in severe pain in the tooth, but the infection will pass along the root canal until this organ becomes devitalized and putrescent, and finally the surrounding tissue of the tooth will become involved, thus causing disease of the alveolar process, the bone proper, or other tissue of the face. The lymphatic glands may also become involved, to the extent of showing considerable enlargement, the cause of which is often overlooked by the physician, and local or general treatment prescribed instead of treating or extracting the tooth.

Permanent Dentition.—The eruption of the thirty-two permanent teeth usually commences with the first molar, often called the "sixth-year molar." This tooth is generally looked upon by parents as belonging to the deciduous set, and consequently when threatened with decay is often neglected.

If no complications exist and the deciduous teeth are "shed" at the proper time, the eruption of the permanent teeth will give but little discomfort, except perhaps the upper and lower third molars. These often require that the overlying gum tissue covering them be thoroughly cut or even removed. Under certain pathologic conditions any of the permanent teeth may fail to erupt into their proper places at the proper time. This is likely to produce serious local and systemic conditions, as indicated by high temperature, spasms, convulsions, facial paralysis, facial neuralgia, false ankylosis of the temporo-mandibular articulation, or cellulitis of the surrounding tissue, often extending to the pharynx, the palate, and the larynx. Pathologic retarded eruption of teeth of the upper jaw may produce inflammation of the maxillæ, or of the maxillary sinus, whence it may extend to the nose or its accessory sinuses or cells. If the pathologic condition is found in the lower jaw, the lymphatic glands of the neck may become enlarged. Whenever symptoms such as have been referred to exist, a careful examination of the mouth should be made by inspection, tactile sense, and the *x*-ray, and any of the teeth which have not erupted at the proper time and in the proper position should be suspected as the probable cause of the trouble, and either liberated or extracted. Especially when the third molars are involved, the most serious consequences may occur.

During the period of the eruption of the permanent teeth the mouth is the theater of great changes. Coincident with their progression, the jaw-bones and their alveolar processes are developing to their full size and form. Complications may arise at any time from constitutional diseases, or from interference with respiration through adenoid enlargements or other obstructions which cause the child to breathe through the mouth. These and other causes, operating on the developing tissues, may prevent the proper formation of the vault of the mouth and the alveolar arches. Under such circumstances the permanent teeth will become crowded and misplaced, causing what is known as irregularity of alignment and mal-occlusion. If this condition is allowed to exist, it becomes next to impossible to keep the mouth in hygienic condition, at least until after the teeth have been lost.

Every consideration points to the importance of guarding the teeth during the formative period against influences the effects of which, immediate or remote, tend to produce malformation of the shape of the mouth and malposition of the teeth.

During Adult Life.—If all the disturbing factors have been guarded against, the development of the jaws will proceed along normal lines; the jaws will be typically formed, and the teeth of both arches will be healthy, in regular alignment, and in correct occlusion. We have thus at maturity the conditions which render easy the care of the mouth during adult life. A tooth-brush with warm water, properly applied, and the energetic rinsing of the mouth by forcing the water through the interstices of the teeth by the action of the tongue and facial muscles; occasionally a little soap of agreeable flavor and containing no free acid, the quill toothpick, and floss silk, are usually all that are required to keep the mouth clean and therefore in healthy condition. Many of the tooth-powders put up by druggists for their general sales are of but little use, while some are undoubtedly injurious. If a powder be used, one having precipitated chalk as the base is best; many other substances used for this purpose are harmful. The following prescription is a good one and can be modified to suit individual cases:

℞.	Calcii carbonatis præcipitati	℥iij
	Sacchari albi	
	Amyli	āā ʒiij
	Saponis pulveris	ʒij
	Olei gaultheriæ	♏xxx
M.	Sig.—Dentifrice.	

The teeth should be kept as free from decay as possible, and when decay sets in it should be eradicated at once. To this end it would be well for the great majority of persons to visit a dentist at least as often as once in six months—in some cases oftener—for examination. These examinations afford opportunity to detect decay before it has progressed far, when it is easily remedied, and also for the removal of accumulations of salivary calculi from around the necks of the teeth.

"Tartar," a deposit which is found in most mouths, cannot be entirely removed with the ordinary brush and powder. Its presence constitutes a menace to the life of the teeth. Starting at the neck, it gradually extends along the root, sometimes, in severe cases, reaching to the apex. Its first effects are swelling and recession of the gums, its ultimate result the loss of the teeth affected through resorption of the alveolar process from the constant irritation of the deposits. Tartar also permits the accumulation of pathogenic organisms around the necks of the teeth, thus forming nuclei of infectious matter.

From Adult Life to Old Age.—The principal enemies of the health of the teeth from infancy to maturity are, as has been seen, decay and salivary deposits. From the latter point on they are reinforced by an ally more powerful for evil than either, namely, pyorrhea alveolaris. This disorder is protean in its manifestations, but in whatever form it presents, the end is inevitably the loss of the teeth attacked unless the ravages be counteracted. (See Pyorrhea Alveolaris.)

It is to one or the other of these causes that the loss of the teeth is due. In most cases the loss may be averted by proper care,—which in this instance may often include treatment,—and the teeth be preserved through the longest span of life. With few exceptions whenever teeth are lost, whether one or two or more, the vacancy should be filled by artificial substitutes. All artificial appliances should be constructed so that they can be removed and cleaned two or three times each day. A single crown, with perhaps a "dummy" attached, may be adjusted so that it will not be removable, but it must be so constructed that it can be kept clean in the same manner as the natural teeth. It is important for esthetic reasons that the arches be full, but more important for hygienic purposes. The functions of mastication and speech cannot be thoroughly fulfilled when any of the teeth are missing.

Hygiene of the Mouth During Illness.—During protracted illness, especially in febrile diseases, patients are often practically unable to give to their teeth and surrounding tissues the degree of daily care necessary to avert caries, inflammatory disorders of the gums, and other diseases. In most cases carious spots appear upon the most susceptible areas, purulent inflammatory phenomena in the gums, pericemental abscesses, etc., develop.

We must here again emphasize the oft-disregarded truth that the treatment of systemic disorders is greatly retarded, and in certain cases rendered altogether impossible, by the neglected state of the mouth. As has just been stated, diseases of the teeth are very apt to occur during long illness or immediately afterward, but the practitioner should bear in mind that in almost all instances it is the result of a lack of proper hygienic attention to the teeth and gums rather than a manifestation of the systemic disturbance. The person entrusted with the care of the patient should be instructed to have the patient brush the teeth at least twice daily. If the prostration be such as to preclude the possibility of the patient himself doing it, it should become a part of the nurse's duty to carry out this most important hygienic measure.

Apart from the disastrous results in and about the teeth from a disregard of this measure, it is perhaps of even greater importance to care for the teeth properly during illness, as the accumulation of infectious matter in the mouth may easily become the origin of disturbances of varied degrees of intensity in the most vital portions of the alimentary tract.

In cases of syphilis, and whenever mercury is freely administered, the mouth should first be placed in as healthy a condition as possible, as inflammatory disturbances of the mouth from the use of mercury are indirectly due to the lowering of the general vital resistance, thus permitting the growth of the pathogenic bacteria within the mouth. This can be averted in nearly all cases, if cavities of decay have been previously filled and all calcareous deposits removed. It should be the aim of the practitioner to eliminate all possible sources of infection and to preserve the teeth and gums, before and throughout the systemic treatment, in a condition as nearly normal as possible.

DISORDERS OF THE GUMS AND ALVEOLAR PROCESSES

Disorders of the gums are divided into two classes—superficial and deep.

The superficial disturbances have in a great measure been treated under the head of general diseases of the mouth, with the exceptions of gingivitis and effects from lead-poisoning.

Gingivitis.—Gingivitis is an inflammation that may be divided into superficial and deep, or marginal gingivitis and interstitial gingivitis (Talbot).

Superficial or marginal gingivitis is a general inflammation involving the surface of the gums and the tissues around the necks of the teeth. It is sometimes more or less localized according to the nature of the exciting cause. If constitutional, it is liable to involve the whole surface; but if caused by some local disturbance, it will be localized according to the degree and location of the irritating factors. When it is localized around the necks of the teeth, it is produced in various ways by calcareous deposits, mechanical appliances such as ill-fitting artificial crowns, fillings overlapping at the cervical margin, impacted food, and other debris which undergoes decomposition through the action of various bacteria, the irritating end-products being the cause of the inflammatory process. These conditions are usually found among persons who neglect the hygiene of the mouth.

The excessive use of tobacco, especially when supplemented by a liberal use of alcoholic drinks, and more certainly where there is a syphilitic history, may produce marked gingivitis which will be exhibited in various forms. One of these, leukoplakia, makes its appearance in the form of white corrugated patches, largely composed of degenerated epithelium. It often extends to the buccal surface of the cheeks or to the roof of the mouth, or may be found upon the tongue. If not properly treated, it becomes a serious affection, as it is often the forerunner of epithelioma.

A form of gingivitis, sometimes called chemical, is usually caused by the misuse of drugs such as arsenious acid, carbolic acid, sulphuric acid, etc. The most serious phase is caused by arsenious acid, used to devitalize the pulps of the teeth. Sometimes the drug is accidentally allowed to come in contact with the gum tissue; occasionally it leaks out under a temporary filling. When this occurs, it causes great pain, and eventually destroys the pericementum and attacks the bone, producing, as a rule, a necrotic condition of the alveolar process of varied degrees of intensity. This disturbance is easily diagnosed, especially if there be a history of arsenious acid having been applied. The symptoms are great pain, loosening of the tooth, and necrosis of the bone, which can be detected by passing a probe along the root. The overlying gum tissue will either slough away or become resorbed, leaving the bone denuded. The dead bone finally separates in the form of a sequestrum.

Gingivitis is common during febrile diseases, such as typhoid fever and pneumonia, arising through the disease itself or through neglect of the care of the mouth at such times.

The over-administration of mercury will produce gingivitis when the mouth is in an unhygienic condition.

Lead-poisoning, such as is observed in men employed in lead mills, in painters, pottery glazers, etc., often produces marked gingivitis. This disturbance is generally indicated by a blue line on the free margin of the gums surrounding the teeth.

Treatment of Gingivitis.—The same principles apply to the treatment of all forms of gingivitis. The first of these is removal or discontinuance of whatever is causing the inflammation, if possible. Calcareous deposits, ill-fitting dental appliances, overlapping edges of fillings, and other sources of irritation to the gum margins should be removed or corrected. Excessive use of tobacco and overdosage of mercury must be avoided. In gingivitis in workers in industrial poisons, such as lead, phosphorus, etc., removal from the poisonous environment is first indicated. Attention must next be given to any systemic cause, if suspected, such as syphilis, gout, or diabetes. Local treatment alone will be of passing benefit if the gingivitis is only a symptom of a constitutional disease. Local treatment consists in getting the teeth and gums into a hygienic condition by removal of calcareous deposits and other irritants, filling of cavities in teeth, and disinfection of the inflamed tissues. The swollen and reddened gums may be painted with tincture of iodin once a day, the parts being kept free from saliva until the iodin dries. A mouth-wash, such as that given below, should be used several times a day.

DISORDERS OF THE DEEP STRUCTURES

The principal disorders of the deep structures are pyorrhea alveolaris and abscesses.

Pyorrhea Alveolaris.—Pyorrhea alveolaris is a subacute or chronic inflammatory disease of the pericemental membrane not infrequently leading to the exfoliation of the teeth. The exciting cause is invariably of bacterial nature; while the predisposing cause may be classified under two headings, namely, local and constitutional, and others of a purely local origin, yet it is not by any means a rare occurrence to observe cases in which both kinds of causes have been instrumental in bringing about the destruction of the pericementum and loosening of the tooth. The local type of pyorrhea is caused by the accumulation of tartar upon the surface of the teeth in the vicinity of the gum margin, which, producing a sufficient degree of irritation, covers the gum and pericementum in the neighborhood of the neck of the tooth into areas of diminished resistance, thus favoring the bacterial invasion which leads to recession of the gum, pericemental destruction, and loosening of the affected tooth. The symptoms are reddening, swelling, and recession of the gum, a purulent discharge from under the gum margin, loosening of the tooth, and fetid breath. The treatment should consist in the thorough removal of the calcareous deposits, and upon this point too much emphasis cannot be placed, as the success of the treatment depends almost wholly upon the care with which this step of the operation is carried out. Following the removal of the deposit, the space between the gum and the root, *i. e.*, the pocket, should be irrigated with an antiseptic solution, repeating this treatment at intervals of a week, or as often as circumstances should require. An antiseptic mouth-wash to be used at least twice daily completes the therapeutic intervention. The following solution may be used to advantage:

℞.	Acidi borici	ʒj
	Phenol	♏xij
	Glycerini	f℥j
	Olei menthæ piperitæ	♏vj
	Aquæ destillatæ	ad f℥vj

Sig.—Use as mouth-wash in full strength or dilute with an equal part of water.

The constitutional type of pyorrhea may be the manifestation of a systemic diathesis, especially the gouty. That the cause of the primary pericemental irritation and subsequent purulent infection is of a constitutional nature cannot be reasonably questioned in the light of the abundant clinical evidence to that effect. In persons of the gouty diathesis the deposition upon the root of the tooth even of the smallest particle of uratic calculus is sufficient to cause a degree of irritation in the pericementum to favor subsequent bacterial invasion. At any rate, it is principally in individuals of the uric acid diathesis that this type of pyorrhea is observed, although it must be admitted that the pathology of constitutional pyorrhea is being connected with doubtful and in many respects questionable hypotheses.

The symptoms of constitutional pyorrhea are identical with those of the local type, although in the former the likelihood of the disease involving the neighboring teeth is greater. Apart from the local treatment, which should be similar to that described in connection with the local type, proper attention should be given to the general condition of the patient. To this phase of the treatment it seems here unnecessary to allude, as it falls strictly within the province of the general practitioner, implying, as it does, the treatment of the systemic disturbance of which the oral disorder is indeed but a manifestation.

ABSCESSES

Abscesses of the alveolar process may be divided into two varieties—alveolar abscess and dento-alveolar abscess.

Alveolar Abscesses.—Alveolar abscesses are those found within the deep structure of the alveolar process. Their origin is somewhat obscure, though it is more than likely that the infection is similar to other deep-seated abscesses that have apparently formed spontaneously. No other explanation can be given, except, perhaps, that the infection has been carried to the parts through the blood-current.

Dento-alveolar Abscess.—Dento-alveolar abscesses are those that are closely associated with one or more teeth. They are usually caused by infection from a diseased pulp, though the infection can be carried from the mouth through the pulp canal of the tooth. In their early stage great pain is experienced, as the infected part is deeply situated. The tooth becomes apparently elongated, caused by the congestion of the surrounding tissue, and is sore to the touch. If the root canal is opened at this stage and properly treated, the abscess can often be cured, but if neglected a true abscess is formed which will extend further into the alveolar process along the line of least resistance, usually pointing and breaking into the vestibule of the mouth. If proper treatment is given these abscesses, especially in the upper jaw, where gravitation favors drainage, they can be cured and the tooth made useful; but the longer curative measures are delayed, the more difficult is the treatment, and the teeth are often lost through delay. When discharged into the oral cavity, the infectious matter is often swallowed, and, when the stomach is inactive, although immune to a great extent, the frequent influx will finally cause various disturbances not only in the stomach but all along the alimentary canal. It is important, when any operation is performed in the region of the mouth, pharynx, or any other portion of the alimentary canal, that the mouth be examined for pus-discharging abscesses and other collections of infectious matter.

Abscesses Breaking Into the Maxillary Sinus.—Occasionally the teeth posterior to the canine in the upper jaw will be the seat of abscesses that point and break into the maxillary sinus, thus infecting that cavity. This infection can be transmitted into the nasal cavity and its accessory pneumatic sinuses and cells or even to the ear, and cases have been known where the infection has entered the brain-case, causing meningitis. Abscesses associated with the upper anterior teeth may point and break into the nasal chamber or pass backward within the bone forming the roof of the mouth, producing abscesses and necrotic foci in the bone that are sometimes mistaken for syphilitic necrosis. Occasionally an abscess from an upper third molar (wisdom-tooth) may point and break into the region of the zygomatic fossa, discharging pus and infection through the tissues of the neck or into the pharynx. The abscess will not yield to local treatment, but when the true cause is found and the tooth is extracted, the parts will usually heal at once.

Abscesses in the Lower Jaw.—Abscesses associated with roots of the teeth in the lower jaw may point and break through the mandible below the external oblique line. When this happens, pus may point anywhere upon the neck or even pass into the thoracic cavity. Sometimes the pus may pass inward through the bone and break into the submaxillary triangle, causing a triangular swelling upon the neck which is occasionally mistaken for some disease of the submaxillary gland.

Abscesses developing upon the lower third molars are most difficult to treat and may become dangerous. The roots are very deep in the jaw and often cause acute false ankylosis of the temporo-mandibular articulation. Through the cellulitis set up in this region, the mandible becomes fixed, and deglutition is most difficult to accomplish on account of the swollen condition of the tissue around the oropharynx. If the abscess should advance through the bone below the angle, it will pass into the region of the upper carotid triangle.

Treatment of Alveolar Abscess.—On general principles abscesses upon the roots of the teeth or in the alveoli should be treated in the same manner as abscesses in any other region of the body, *i. e.*, removal of the source of primary irritation and infection, securing of ample drainage, and stimulation of the growth of healthy granulations by proper medication. The special treatment, particularly in the case of an otherwise strong and useful tooth, consists in the removal, by mechanical means, of the decomposed contents of the root canal or canals and in cleaning them as thoroughly as practicable. Suitable dressings are then introduced in the canals, the operation being repeated until all symptoms of putrefactive action have disappeared. This being secured, the root canals are sealed permanently with any of the filling materials advocated for the purpose.

CANCRUM ORIS

Cancrum oris, or noma, is a form of gangrenous stomatitis occurring in young children.

Etiology.—The disease is found particularly among poorly nourished children who live in unhygienic surroundings. It is apt to follow acute exanthemata, such as measles and scarlet fever, and epidemics are liable to occur in these cases in hospitals. The specific infecting organism has not been isolated, but the fusiform bacillus and spirillum of Vincent are frequently present.

Symptoms.—The disease begins as an ulceration of the mucous membrane of the mouth, usually about the point where the cheek joins the gum. This ulceration spreads rapidly to the deep tissues of the mouth and cheek, often laying bare the bone and causing any teeth that are present to be lost. The invasion of the cheek causes marked swelling of the side of the face affected, and a red spot appears externally. The swelling feels hard, and soon takes on a dusky hue. The cheek rapidly becomes gangrenous, turns black, and frequently sloughs away, exposing the interior of the mouth. The odor is almost unbearable. The disease has very marked toxic effects on the general system of the child. The temperature rapidly reaches 104° or 105°, with a corresponding increase in the pulse-rate. As the resistance of the patient is rapidly overcome by the poison, the pulse becomes weak and irregular, and the respirations rapid. Just before death, the temperature becomes subnormal, and the child's skin cold and livid. During the course of the disease, the patient usually suffers from septic diarrhea brought about by swallowing the gangrenous material from the mouth.

The **prognosis** is very unfavorable, as recovery rarely occurs.

Treatment.—The ulcer in the mouth should be cauterized with pure nitric acid on an orangewood stick, care being taken not to allow the acid to spread to healthy tissue. If the teeth become loosened, they should be removed. The mouth should be kept as clean as possible with a 1 : 4000 solution of potassium permanganate, used at frequent intervals. Shreds of gangrenous tissue should be cut away with scissors from time to time, and the parts touched with nitric acid. The gangrenous tissue of the cheek must also be removed. If the patient recovers, the disfigurement may be corrected to some extent by plastic operations. The general condition of the patient requires judicious stimulation.

LUDWIG'S ANGINA

Ludwig's angina is a cellulitis beginning in the submaxillary region, and extending into the tissues of the floor of the mouth, the base of the tongue, the pharynx and larynx.

Etiology and Pathology.—It usually starts as a perilymphangitis of the submaxillary salivary gland, due to the invasion of micro-organisms, generally streptococci, though the pyogenic micrococci and other bacteria may be the exciting cause. The point of entrance of the bacteria may be the suppurating root of a tooth, inflamed tonsils, the duct of the submaxillary gland, or ulceration of the mucous membrane of the mouth. The infection is above the fascia covering the submaxillary triangle, and below the mylohyoid muscle. From its point of development it is carried by the lymphatics and connective tissue upward into the substance of the mylohyoid muscle and backward to involve the walls of the pharynx and larynx. Invasion of the latter may result in death from suffocation.

Symptoms.—There is a swelling in the submaxillary triangle, which rapidly increases in size, and is accompanied by induration and tenderness. The mucous membrane of the floor of the mouth finally reaches the level of the tops of the lower incisor teeth, and is very hard to the touch. The swelling forces the tongue up, causing the mouth to be held open. There is an increase in the flow of saliva. Only one side of the floor of the mouth is at first involved, though later the inflammation may spread to both sides. The cellulitis at the same time spreads backward to the pharynx and larynx, causing embarrassment of respiration and sometimes suffocation. The characteristic point of distinction between Ludwig's angina and ordinary submaxillary cellulitis is the rapid spread of the inflammation to the floor of the mouth and the region of the glottis, the entire course sometimes not occupying more than twenty-four or forty-eight hours. The local symptoms are usually accompanied by high temperature, rapid pulse, and great prostration.

Treatment.—There is perhaps no disease that requires more prompt attention than Ludwig's angina. Delay of an hour may be fatal to the patient's chances of recovery. As soon as the diagnosis is made, the swelling must be attacked by free incision of the *neck*. No amount of opening into the floor of the mouth alone will be of any avail. The incision should be made in the submaxillary region, parallel with the lower border of the jaw, and carried beneath the deep fascia; otherwise it will not reach the seat of the lesion. Another opening may be made in the median line beneath the chin and connected with the first with a rubber drainage-tube. It is quite safe to carry the median incision as far as the mucous membrane covering the floor of the mouth without danger of undue hemorrhage, as no large blood-vessels cross the median line. Pus is not always obtained by early incision, but the spread of the inflammation is nearly always checked, and the swelling gradually subsides. This improvement is accompanied by fall of the temperature and pulse-rate to normal in a few hours. Delay in following out this treatment is disastrous, for little hope of recovery can be entertained if the larynx becomes involved. If the case is seen late, when dyspnea shows that obstruction of the respiratory passages is threatened, tracheotomy should be performed at once, followed by the measures described above. The general condition of the patient requires rest in bed, liquid diet, and stimulants.

Soon after recovery, search for and removal of the exciting cause, such as a diseased tooth or tonsils, should be carried out. If the exciting cause is a diseased tooth, it should be extracted, provided that the operation can be accomplished without danger of additional infection of the surrounding tissue.

DISEASES OF THE MOUTH, TONGUE, AND SALIVARY GLANDS

By J. Dutton Steele, M.D.

Revised by George Morris Piersol, M.D.

DISEASES OF THE MOUTH

MOUTH INFECTIONS

The lessons that may be learned from the subject of mouth infection are so fundamental, and hence so important in etiology, diagnosis, and prognosis, that it would be well to have the section in which it is considered placed in the first part of every book on therapeutics.

Etiology.—No practical man can deny the influence of this condition in the production of forms of arthritis; in endocarditis; in inflammations of the pharynx; in inflammations of the gastro-intestinal tract, notably the gastric inflammations antecedent to anemia; in toxic anemia; in some obscure, mild, long-continued fevers the writer has found it to be the factor; in toxic nervous disorders, as neuritis; in many functional disorders of the nervous system which are toxic in origin; and, finally, in various forms of indigestion or chronic gastritis. What therapeutist can afford to neglect an infected mouth in the preventive and curative treatment of these disorders? We owe to William Hunter, more than to any other one man, insistence upon and clear demonstration of the etiologic importance of mouth infection.

Symptoms.—No disorder is more readily demonstrated, more frequently overlooked, or, if noticed, oftener neglected in the scheme of therapeutics. Inspection is sufficient to disclose the condition. The process may be local or general. It may be limited to the vicinity of one tooth or extend throughout the mouth. If present, it may be indicated by a carious tooth, by inflammation of the contiguous gums, by an abscess or inflammation at the root of the tooth. More evident processes are seen in gingivitis, or in stomatitis, catarrhal, suppurative, and ulcerative. Exploration may be aided by the *x*-rays, particularly if the infection is at the root of a tooth, or if the jaw-bone is involved. Careful exploration of the antrum must be made.

The significance, the fetor, the discharge, the painful mastication, and other local symptoms and signs must be sought for in works on diagnosis.

It must not be forgotten that "plates," "bridges," one or more false teeth, and other artificial masticatory aids may underlie the infective process. Moreover, the process may be secondary, as in scurvy, rachitis, syphilis, etc.

Diagnosis.—This is easy. The point at issue is to look for the possible occurrence of the mouth infection and to recognize its relationship to other existing near or remote disorders.

Prognosis.—The writer has for many years called the attention of his classes to the influence of mouth infection on the prognosis of pneumonia, typhoid fever, and other infections. It adds immensely to the gravity of the case, not only because of the existing local disorder, but because of its past effect on the organism. The resistance and the nutrition are influenced. Excretory and secretory organs and the defenses of the organism are already overstrained by the chronic infection, and cannot rise to the new combat with the vigor of a mouth-clean subject. Moreover, the catarrh and functional disorders of the gastro-intestinal tract serve as a further handicap to the stricken patient. To these must be added the frequency of reinfection, because the organisms may be harbored in the tooth cavities and the "plate" or "bridge" curves so frequently seen. I am sure bronchopneumonias are thus likely to recur, while the long-drawn-out septicemia of typhoid fever, or even relapses of the disease, can have similar explanation. In anemia, chronic toxemia, and infections the course is in accordance with the degree of success attained in the treatment of the primary mouth disorder. If the anemias have not progressed too far, they are likely to be cured and their recurrence prevented. For the arthritis and chronic gastro-intestinal conditions, a similar statement can be made.

Treatment.—In this day of thorough practical knowledge of sepsis and its management a discussion of the treatment of oral sepsis is almost academic. It is sufficient to say that local causes must be dynamited out; the tooth or teeth removed; the imported artifices of the dentist destroyed and near-by cavities treated. It matters very little, says Hunter, what means you select, so that you do something. His precepts and procedures are so clear and forceful that we reproduce them here:

"When I say oral sepsis, I do not mean any general application of mild astringents or antiseptic washes. I mean—

"1. The direct treatment of each lesion in connection with a diseased tooth by strong antiseptic solutions; carbolic acid (1 in 20 or 1 in 40) rubbed in by means of a camel's-hair brush or a piece of cotton-wool directly over the diseased root. This treatment should be periodically applied to each diseased tooth as long as the patient delays having the tooth removed or as long as there is the slightest sign of redness around the root. A teaspoonful of 1 in 20 carbolic acid in half a tumbler of water forms an agreeable mouth-wash.

"2. Still better, it can be done by removing all diseased stumps and roots, in particular those lying underneath any tooth plate.

"3. There is a necessity for recognition on the part of the dental surgeon that the conditions he deals with are in all cases septic; he must not be simply content to supply his patient with tooth plates. The patient will have to be educated, and shown that these plates are the cause of septic trouble unless they are daily sterilized.

"4. There must be an entire avoidance of any dental apparatus (liable to become septic) which cannot be removed, and therefore which cannot be kept aseptic.

"Oral antisepsis thus carried out is a field of preventive medicine which I think can be worked in with the most extraordinary success by the doctor, the surgeon, the dental surgeon, and the patient."

CATARRHAL STOMATITIS (SIMPLE STOMATITIS; ERYTHEMATOUS STOMATITIS)

Simple or catarrhal stomatitis is characterized by more or less diffuse catarrhal inflammation of the mucous membrane of the oral cavity, associated with an increased secretion of saliva. The inflammatory process is sometimes local, occurring in whitish spots that are dry and glazed, or the whole oral cavity is affected and the mucous membrane is red and swollen.

Etiology.—Catarrhal stomatitis is produced by a variety of causes, both infectious and toxic, a recital of which will indicate the line of treatment to pursue in the respective forms. Children are much more liable to it than adults. The causes of simple stomatitis are:

1. Mechanical, chemical, or thermic insults to the oral mucous membrane, such as the irritation produced by a sharp or carious tooth, tobacco, too hot or too highly seasoned foods, or too hot beverages.

2. Local infections that most frequently are the result of lack of cleanliness, which gives rise to accumulations of food and epithelium in the mouth and favors the growth of the mouth bacteria. This lack of cleanliness usually comes from carelessness in the care of the mouth and teeth.

It is probable that infection plays a great part in the production of all forms of stomatitis, since the original cause, whatever it is, reduces the resistance of the oral mucous membrane and favors infection by the varieties of bacteria that are normal inhabitants of the mouth.

3. Catarrhal stomatitis occurs in the course of the acute febrile diseases, especially typhoid fever and pneumonia, where the resistance of the patient is reduced by the primary infection and any lack of cleanliness in the mouth quickly leads to local infection by the mouth bacteria. This occurs the more readily when the patient's sensorium is so affected by the severity of the infection that he is incapable of attending to the condition of his own mouth.

There is likewise danger of stomatitis and associated oral sepsis in diseases of the central nervous system and in various wasting conditions, as tuberculosis, carcinoma, etc., in which patients are unable to attend to their own needs.

Catarrhal stomatitis frequently complicates various acute gastrointestinal disorders. It is not uncommon in cases of gastric ulcer during the period of rectal feeding, where dryness of the mouth leads to inflammation and secondary infection. The presence of oral sepsis in all these conditions seriously complicates the course of the primary affection by adding to the patient's discomfort and by forming an additional focus of infection.

4. Simple stomatitis may occur in the course of various constitutional diseases, as gout, diabetes, nephritis, urticaria, and during pregnancy and lactation.

5. The eruptions of the various exanthemata manifest themselves in the oral mucous membrane, frequently before they appear upon the skin. The only danger to be feared from such cases is that the general condition of the patient is such as to favor the development of oral sepsis.

6. Finally, simple stomatitis may result from the use of iodids, mercury, arsenic, the bromids, etc.

Since primary or secondary infection by the mouth bacteria is probably the most important element in the production of stomatitis, cleanliness is the essential part of the prophylactic and curative treatment. All circumstances that favor infection by mechanical irritation must be removed. Thus, decayed teeth should be extracted or rendered harmless. False teeth, which may cause trouble by irritating a sensitive mucous membrane, should always be removed at night, and should be cleaned after each meal when this is found necessary. When there is a tendency to recurring attacks of stomatitis, smoking and the use of highly seasoned or very hot foods or beverages must be forbidden.

Treatment.—*To clean the mouth*, pure water is as efficient and pleasant as any of the medicated washes. It should be held in the mouth for at least two minutes, and should be forced in and out through the closed teeth, and into all the corners of the oral cavity. To facilitate thorough washing, the mouthful taken at one time should be as large as possible and yet allow for the easy action of the lips and buccal muscles. By its use the mucous membrane is kept moist and refreshed and the desired cleanliness is obtained.

If the inflammation is well established, the use of various medicated mouth-washes is necessary. Probably the best local remedy for continuous use is *chlorate of potash*. This drug when absorbed from the gastro-intestinal tract is freely eliminated, unchanged by the saliva, and so may be given internally as well as used locally as a wash.

In adults there is probably no advantage in its administration by the stomach, as it can be used freely as a mouth-wash, but in children too young to be taught to use a wash this mode of administration has great advantages.

For *local application* the drug should be used either as a powder or in the strength of 2 to 3 per cent. in water as a wash; for adults every hour or two during waking hours. It must be held in the mouth and rinsed about for at least two minutes.

Internally the dose for adults is 10 to 20 grains three times a day. Its internal use is contraindicated in nephritis, and even its local use may be dangerous in bad cases of acute nephritis. The combination of an astringent, as a salt of iron, with the potassium salt is often advantageous. A vegetable astringent is likewise useful. A prescription which calls for the following combination is often employed:

℞.	Potassii chloratis	ʒj–ʒij
	Tr. ferri chloridi	ʒij
	Inf. rhois glabræ	q. s. ad. ℥iij

M. Sig.—ʒj in ½ glass water as mouth-wash.

A small portion may be swallowed, the iron being of much service in anemic subjects.

Another vegetable astringent, pomegranate, in combination with potassium chlorate, also forms the basis for many mouth-washes. In late and sluggish forms of stomatitis a small portion, as one grain of chlorate of potash to the ounce of fluidextract of pomegranate, may be used. A teaspoonful of the solution diluted is a good mouth-wash.

If the use of potassium chlorate is contraindicated, peroxid of hydrogen in the proportion of 1:4 to 1:8, or borax in the strength of 10 to 15 grains to the ounce of water, may be used as a wash. There is no objection to other medicated washes provided they fulfil the conditions mentioned in the article upon general hygiene.

If the *pain* is severe, it may be allayed by the use of cool washes, bits of ice, or penciling with 2 per cent. solution of cocain, with due regard to a possible idiosyncrasy of the patient to the latter drug.

In infectious fevers and wasting diseases, including gastric ulcer, cleanliness is the first and most important means of combating the danger of oral infection. In helpless cases the mouth must be cared for by the attendant, and should be washed at frequent intervals with clean water or some mild antiseptic solution, as boracic acid or peroxid in the strengths mentioned. A mouth-wash both pleasant and efficient for use in acute infections is the following:

℞.	Sodii boratis	ʒiv
	Glycerini	f℥j
	Olei eucalypti	♏v
	Aquæ dest.	q. s. ad. Oj

If the mouth and tongue are very dry, liquid albolene or liquid vaselin should be used as a spray or by penciling. This soothes and protects the parched mucous membrane. Glycerin and boracic acid or glycerin alone may be used for the same purpose, but are not so efficient.

Cracked and parched lips must be cleaned and anointed with cold-cream or vaselin. If ulcers form, they should be touched with a solution of nitrate of silver (12 per cent.).

Catarrhal Stomatitis in Children.—Catarrhal stomatitis is relatively more common in children, because of various conditions peculiar to that age. The mouths of nurslings are exposed to traumatism from the act of sucking, dentition is a frequent cause, and too rigorous cleaning or the rubbing of a swollen gum may produce inflammation. As in all forms of stomatitis, but especially so in infants, lack of cleanliness and infection are the all-important causes.

Prophylaxis.—As is suggested by what has been said of the etiology, in children prophylaxis is far more important than the actual treatment. The essential feature of the prophylaxis is to maintain scrupulous cleanliness of everything that enters the infant's mouth. Nipples and bottles should be boiled before and after each feeding; the breasts, as well as the infant's mouth, should be carefully cleansed with a 2 or 3 per cent. solution of boracic acid, and if the child is bottle-fed, a clean milk, preferably one of the so-called "certified" milks, should be used.

Treatment.—The treatment of the condition is complicated by the fact that infants cannot suck during the period of acute inflammation. In such cases food should be given by a spoon or dropper. The mouth must be gently cleaned every half hour or so when the baby is awake by a 2 per cent. solution of biborate or bicarbonate of soda on a soft cotton swab or in a dropper.

In older children chlorate of potash is the best remedy, and in young children who do not understand how to wash their own mouths, the drug can be given internally, acting locally in its passage through the saliva. It should be used with caution, since children are relatively more susceptible to its action than adults, and in some cases it has a decided toxic effect, producing drowsiness, cardiac weakness, cyanosis, and suppression of urine.

Dosage of Potassium Chlorate.—The following table taken from Rotch shows the minimum doses that may be safely administered at the different ages.

AMOUNT OF POTASSIUM CHLORATE WHICH CAN BE SAFELY GIVEN IN TWENTY-FOUR HOURS AT DIFFERENT AGES

AGE.	GRAMS.
Under 1 year	1.0
1 to 2 years	1.5
2 to 6 years	2.0
6 to 8 years	2.5
8 to 14 years	3.0

In severe cases, or when the inflammation is very resistant to treatment, the mucous membrane should be gently penciled with a 1 per cent. solution of argentic nitrate once daily, followed by careful washing with cold sterile water.

The saliva of children suffering with stomatitis is often acid and irritating, and may cause eczema of the chin; this should be combated by keeping the skin dry and protected with vaselin.

APHTHOUS STOMATITIS (HERPETIC STOMATITIS; FOLLICULAR OR VESICULAR STOMATITIS)

This disease consists of the eruption in the oral mucous membrane of small subepithelial vesicles which have a glistening appearance and are gray-white in color. Each blister is surrounded by a red areola, and there is usually some associated diffuse catarrhal stomatitis. These vesicles, as a rule, break down within twenty-four hours and form small ulcers.

Etiology.—No cause, local, general, or infectious, has as yet been determined, and it seems probable that the condition is a true herpes. In a few cases, however, staphylococci have been found. It is most common in children between the beginning of dentition and the end of the second year. It occurs chiefly in connection with disorders of the gastro-intestinal tract and dentition, but does not seem to be directly connected with these affections, and frequently occurs alone. It also occurs in adults, chiefly women at menstruation and during the puerperium.

The local **symptoms** are pain and salivation without fetor, unless extensive ulceration develops. In children the constitutional disturbance is often considerable, and the child is listless and feverish and refuses nourishment. The disease is self-limited, and unless there is secondary infection the prognosis is good.

Treatment.—The object of treatment is to prevent further infection and to allay pain. In general the local treatment directed toward disinfection is the same as in catarrhal stomatitis.

To allay pain in bad cases the patches may be touched with a solution of cocain (1 to 2 per cent.), just before giving nourishment. The food should be given by a spoon or dropper if necessary.

If ulcers form, they may be painted with a 10 per cent. nitrate of silver solution, or touched with a solid stick of lunar caustic. A solution of potassium permanganate (1 : 150) has also been recommended for this purpose.

Ulcerations, local and general, painful or painless, simple and septic, are relieved by the local application of a saturated solution of iodoform in ether. It relieves the pain of the simple solitary ulcer, it cleanses the more septic ulcers or abrasions, and it stimulates the healing process. It may be applied with a camel's-hair brush. The brush is better than absorbent cotton.

THRUSH (PARASITIC OR MYCOTIC STOMATITIS; SOOR, MUGUET)

This is an infection of the oral mucous membrane by a species of mold or hyphomycetes. The organism is not, as was formerly thought, the oïdium albicans, and its exact classification is unknown. It is found in scrapings of the diseased area and consists of delicate jointed filaments in which spores are developed. Thrush is most common in the mouths of nursing infants, but may affect older children and may occur in adults in the final stages of various wasting fevers and cachectic states, but the disease follows the general rule of infections, and is much more likely to attack mucous membranes whose resistance is lowered by previous existing inflammation or bad hygienic conditions. Thus its development is favored by catarrhal stomatitis, and consequently it is likely to occur in children who have other diseases or who are in bad hygienic surroundings.

Etiology.—The organism is carried to the mouth by dirty nipples, bottles, or other eating utensils, and there is danger of frequent reinfection by the same channels. The attacks usually commence with a catarrhal stomatitis, if this condition did not exist previously.

Upon the reddened mucous membrane the characteristic white patches form, resembling curds of milk, but differing from them in that they cannot be easily removed. The lips, tongue, gums, and hard and soft palate may be affected, usually in the order named. Occasionally the infection spreads into the pharynx and esophagus, and indeed in rare instances may spread to other mucous membranes.

The local **symptoms** are almost identical with those of catarrhal or aphthous stomatitis, with this difference, that in thrush the oral secretions are more apt to be decreased.

Infants with thrush very quickly lose weight and strength, since the stomatitis prevents them from taking a proper amount of nourishment.

The **prophylactic treatment** consists in rigid cleanliness of the mouth and of everything which comes in contact with the oral mucous membrane. Additional precaution must be taken when there is already a catarrhal stomatitis.

Curative Treatment.—Cleanliness forms an important part of the curative treatment as well, since reinfection frequently takes place from nipples and other utensils which have not been properly cleaned and sterilized.

The mouths of infants should be carefully cleaned after each feeding, and also between feedings, and the spots of thrush should be thoroughly and somewhat vigorously rubbed with the following formula (Rotch):

℞.	Sod. borate	1 pt. (10 gr.)
	Glycerin	7 pts. (1 dr.)
	Water	10 pts. (2 oz.)

In older children and in adults the following washes may be used: Sodium sulphate (12 per cent.), sodium bicarbonate (12 per cent.), or potassium permanganate (1 : 500).

The **constitutional treatment** consists in attention to the general strength of the patient and to the correction of any dietary faults that may exist. The nutrition must be sustained by proper food and stimulants until the disease is under control and the child is again able to nurse.

ULCERATIVE STOMATITIS (PUTRID SORE MOUTH; FETID STOMATITIS)

This affection occurs from many different causes and under a great variety of conditions. The lesions vary from superficial ulcers to those that are widespread and deep.

Etiology.—As in other forms of stomatitis, there is almost always some predisposing cause that lowers the resistance of the oral mucous membrane and renders it susceptible to the special irritation that produces the ulceration; consequently it may be said that the condition rarely occurs in a perfectly healthy individual. Overcrowding, bad food, neglect of the mouth, and unfavorable general hygienic conditions favor its development. Infection by the mouth bacteria plays a part in most cases, either as the exciting or as the complicating factor.

Primary Local Form.—Occasionally the condition appears as a primary local disease of unknown origin. The pyogenic bacteria are usually present, but a number of observers lay stress upon the occurrence of the fusiform bacillus of Vincent in this affection. This variety of the disease may become epidemic. The primary form occurs chiefly between the ages of four years (that is, after the eruption of the teeth) and puberty, but is also found in adults.

Traumatic Form.—Ulcerative stomatitis is more often of traumatic origin, and follows mechanical, chemical, or thermal irritation of the same sorts that produce catarrhal stomatitis, of which, indeed, ulceration is frequently the advanced stage.

Under the head of traumatic stomatitis belongs the sublingual ulcer on the frenum of the tongue in whooping-cough, which is produced by injury of the tongue by the lower incisor teeth during the violence of coughing.

Bednar's aphthæ are shallow ulcers upon the hard and soft palate which occur in infants from too rough cleaning of the mouth, or from the pressure of improperly shaped rubber nipples, and are usually aggravated by secondary infection by the mouth bacteria.

Intoxications.—Ulceration is common in the severe forms of intoxication with mercury, phosphorus, lead, arsenic, the iodids, bromids, and antipyrin.

Infectious Origin.—Certain of the infectious diseases, as measles, scarlet fever, and typhoid, especially when they occur in ill-nourished children, may be complicated by severe ulceration of the oral mucous membrane, and the same is true of scurvy and leukemia.

Riga's aphtha may be regarded as another form of ulcerative stomatitis. It consists of an indurated ulcer on the frenum of the tongue in debilitated children and occurs at about the time of the first dentition. The disease is seen chiefly in southern Italy.

Specific Forms.—There are various specific ulcerations of the mouth the treatment of which belongs more particularly under the head of the primary condition. Such are the ulcerations occurring in syphilis, tuberculosis, carcinoma, impetigo, pemphigus, and foot-and-mouth disease.

Treatment.—As in catarrhal stomatitis, the most important indication for treatment of ulceration of the mouth is the removal of the source of irritation and the conditions that hinder or prevent healing. In addition to this, and scarcely less important, scrupulous cleanliness of the mouth must be insisted upon. This is obtained by the use of sterile water or mild antiseptic washes, which remove the particles of food, mucus, and epithelium that favor the growth of the mouth bacteria, a condition which favors infection of already existing ulcers and the formation of new ones.

All sources of local irritation must be removed, such as carious or broken teeth, badly fitting plates or artificial teeth, and excess of tartar.

Of prime importance in the management of the epidemic form are isolation and rigid antiseptic precautions.

The *constitutional treatment* of the primary form of the disease consists of a mild and not irritating diet, preferably liquid or semi-liquid, and avoidance of sweets and acids. Constipation must be remedied and other constitutional faults corrected.

In uremia and diabetes the treatment must be systemic as well as local, although the latter must not be neglected, since the condition of the mouth in such disease is a matter of much importance to the patient's comfort, as well as a complication in the course of the primary disease.

One of the best *local methods* of treatment for ulcerative stomatitis, in all but young children, is the prompt cauterization of the ulcer by argentic nitrate. This relieves the pain and hastens the healing of the ulcer. The drug is best applied in strong solution (12 per cent.) with a cotton swab, and the application should be repeated once or twice at intervals of twenty-four hours.

The best remedy for continuous use is *chlorate of potash*, which is employed in the manner indicated in the section upon Catarrhal Stomatitis, either as a mouth-wash or internally, or it may be applied directly to the ulcer in powder form in full strength or mixed with an equal quantity of boracic acid.

If potassium chlorate is contraindicated, a boric acid or borax wash may be used instead.

If the ulcers lie in a fold of the buccal mucous membrane or are exposed to the friction of other structures, as between the gums and tongue, or cheeks and gums, they must be protected by strips of soft linen or gauze. To relieve the pain, the ulcers may be thoroughly cauterized by nitrate of silver, and bits of ice may be held in the mouth, or the ulcers may be penciled with a 2 per cent. cocain solution.

In childhood ulcerative stomatitis is treated in much the same manner as the catarrhal form, by alkaline washes in infants, and chlorate of potash in older children. In deep ulceration the ulcer should be touched with a 2 per cent. solution of argentic nitrate.

MERCURIAL STOMATITIS (PTYALISM)

This disease generally commences in some pre-existing lesion of the mucous membrane, which may be produced by any form of irritation or trauma. Intoxication with mercury causes inflammation of these small abrasions and lowers the resistance of the tissue to bacteria. Infection by the mouth bacteria then follows and leads to catarrhal stomatitis and later to ulceration.

The existence of these small lesions in the mouth is a very important factor in the development of mercurial stomatitis, and there is no doubt that individuals with healthy and intact oral mucous membranes will resist the toxic action of mercury much longer than persons whose mouths are not in a perfectly healthy condition. It is possible that in some cases apparent susceptibility to mercury is dependent quite as much upon the condition of the mouth as upon any real idiosyncrasy to the drug.

Prophylaxis.—Much can be done to prevent the development of stomatitis during the administration of mercury by insisting upon the most rigid care of the mouth. Before a course of the drug is commenced, the oral mucous membrane should be carefully examined, all abrasions touched with the strong solutions of nitrate of silver (12 per cent.), and every precaution taken to remove any lesion that would form a point of infection. The patient should consult the dentist and have the teeth put in perfect order. Tobacco and irritating food and drinks must be avoided. The most scrupulous cleanliness should be insisted upon, according to the rules given in the section upon general hygiene. These precautions must be maintained not only during the course of treatment, but for several weeks after the drug is stopped.

Treatment.—If the stomatitis is once established, treatment consists in the withdrawal of the mercury, the institution of efforts to disinfect the mouth and to check the progress of the already existing ulcers, and to prevent the formation of new ones. Here, as in other forms of oral inflammation, chlorate of potash is one of the most useful remedies. It possesses considerable antiseptic power and is also an astringent. It should be used in the manner described in the section upon Catarrhal Stomatitis. In order to increase the astringent effect of a mouth-wash, it is often of advantage to combine tincture of the chlorate of iron with the potassium chlorate. Hydrogen peroxid (1 : 3 or 1 : 4) is an excellent disinfectant, and may be used freely as a mouth-wash or in an atomizer. Carbolic acid (1 : 300) may be employed if the taste is not unpleasant. Boracic acid is not satisfactory and its germicidal properties are too weak. Potassium permanganate, if used often enough to be efficient, will discolor the teeth.

The ulcers should be thoroughly cauterized early in the treatment by a strong solution of argentic nitrate, bromin water, chromic acid, or tincture of iodin. For control of the excessive salivation atropin is the most efficient drug. The elimination of the mercury should be hastened by hot baths, free catharsis, and the liberal use of alkaline water. In severe cases a liquid diet is essential.

DISEASES OF THE TONGUE

Acute catarrhal inflammation of the mucous membrane of the tongue is not infrequently associated with a simple stomatitis and is a mild affection.

ACUTE GLOSSITIS OR PARENCHYMATOUS GLOSSITIS

This condition, unlike acute catarrhal inflammation of the membrane, is a rare but severe condition. It is characterized by pain, great swelling, salivation, fever, and the systemic signs of infection. It arises generally from infection after a self-inflicted bite, the bite of insects, or from septic wounds of any kind. Mercurial poisoning or acute infectious diseases sometimes appear to be the exciting cause. The inflammation may be entirely unilateral (hemiglossitis), especially in the early stages. Acute glossitis is a serious affection, and too often goes on to suppuration and gangrene, although it may resolve.

The **treatment** is essentially surgical, and free incisions should be made as soon as the presence of pus is suspected. In the earlier stages, when resolution is hoped for, the mouth should be kept clean and potassium chlorate used locally. Bits of ice may be held in the mouth to allay the pain, which is intense. The tongue may be painted with a 5 per cent. solution of cocain or 1 : 1000 adrenalin to reduce the swelling, or if the enlargement becomes so great as to embarrass breathing, scarification or leeching may be necessary, but the danger of secondary infection must be borne in mind. The general treatment must be supportive.

CHRONIC INFLAMMATION OR CHRONIC SUPERFICIAL GLOSSITIS

The tongue is dry, smooth and glossy, and either whitish, as if burned by caustic, or raw looking and red. The mucous membrane is thinner than normal owing to the loss of its epithelium.

The disease arises from long-continued irritation, as by alcohol, irritating foods, broken teeth, and especially tobacco. Chronic dyspepsia and constipation occasionally appear to be exciting causes.

LEUKOPLAKIA GLOSSITIS

Leukoplakia glossitis is a chronic inflammation of the tongue, the affected areas of which are white and smooth, and the mucous membrane is thickened. The patches are at first localized at the point of irritation, but later become confluent. The disease is produced by the same causes as superficial glossitis, namely, chronic irritation, especially tobacco, and sometimes syphilis. Its course is chronic, spontaneous recovery rarely occurs, and it may develop into carcinoma.

The **treatment** of both chronic glossitis and leukoplakia is similar, consequently the two affections may be considered together. The essential feature of the treatment consists in the removal of the conditions producing irritation, if this be possible. Tobacco, especially in the form of pipe-smoking, and alcohol must be forbidden, and all abnormal conditions of the teeth must be remedied. Mild alkaline washes, such as borax or bicarbonate of soda (2 to 3 per cent.), are the best forms of continuous local treatment. In chronic glossitis all ulcers must be painted with nitrate of silver (5 per cent.), chromic acid (2 per cent.), or sulphate of copper (2 per cent.). In leukoplakia the diseased areas should be painted with chromic acid (2 per cent.). If syphilis is suspected, the appropriate treatment must be instituted.

Papillomatous outgrowths must be carefully watched for and promptly removed, to lessen the danger of the development of carcinoma. This is not uncommon in both diseases, but is especially likely to occur in the papillomatous type of leukoplakia.

GEOGRAPHICAL TONGUE (WANDERING RASH OF THE TONGUE; ECZEMA OF THE TONGUE; RINGWORM OF THE TONGUE)

This is characterized by hyperplasia and desquamation of the superficial epithelium of the tongue, forming denuded areas that spread in intersecting circular patches while the centers heal, giving the tongue a curious and characteristic appearance which has been compared to a map. It is almost exclusively a disease of children, but in obstinate cases may persist until early adult life. The origin is uncertain. The course is very chronic and relapses are frequent. The affection is usually without subjective symptoms, but occasionally there is some itching and burning.

The **local treatment** should consist of the use of a mild mouth-wash, such as borax, bicarbonate of soda, or potassium chlorate. To relieve the burning, if it is present, the tongue should be painted with a 2 per cent. argentic nitrate solution.

The **general treatment** consists of the correction of any constitutional disturbances that may be present and general tonic treatment. The diet must be carefully regulated and anemia looked for and treated. The use of alkaline waters is sometimes of benefit.

ACUTE EDEMA OF THE TONGUE

This may occur as a part of a general urticarial eruption. It may be the first manifestation of the condition, and hence the diagnosis may be difficult. The swelling is often considerable and may cause serious obstruction to breathing. In such cases prompt treatment is necessary. Thorough and rapid purgation must be induced and the tongue painted with a 5 per cent. cocain solution or adrenalin chlorid (1 : 1000). If the swelling does not promptly subside, the tongue must be scarified or leeches applied, and the possibility that tracheotomy may be necessary must not be overlooked.

DISEASES OF THE SALIVARY GLANDS

HYPERSECRETION (PTYALISM)

The normal amount of saliva secreted in the twenty-four hours is from 2 to 3 pints. A physiologic increase occurs during the taking of food and during dentition. The name ptyalism is given to a pathologic increase in the amount of secretion which occurs (1) during the administration of certain drugs, notably mercury, the iodids, and tobacco; (2) it may accompany the early stages of gestation, uterine disease, or various gastric diseases; (3) salivary secretions may be increased in obstructive disease of the pancreas; (4) it accompanies certain functional nervous diseases, as exophthalmic goiter and hysteria, and certain mental states; (5) there may be so-called critical ptyalism in certain infectious diseases, especially smallpox.

The **treatment** consists in the removal of the cause when it is possible.

When the flow of saliva is so great as seriously to interfere with the patient's comfort, full doses of atropin will give temporary relief. The bromids and opium have also some power to check secretion. Gargles and mouth-washes have no effect upon the flow of saliva, but may be employed to correct an associated bad taste in the mouth. For this purpose chlorate of potash is by far the best remedy.

XEROSTOMIA (APTYALISM; DRY MOUTH)

Chronic suppression of the saliva is accompanied by dryness of the mouth and tongue, which becomes red and fissured so as to interfere seriously with mastication, deglutition, and articulation.

The condition is found in connection with a variety of conditions, but how far these can be considered responsible for the suppression of the secretion is not clear. It occurs in the course of diabetes, in the convalescence of typhoid fever, and as one of the sequels of mumps. It also appears to be one of the manifestations of neurasthenia, especially during the menopause. Digestion and general nutrition are usually unimpaired. The disease is not a common one.

Treatment directed toward the restoration of secretion is usually unsatisfactory. It consists in the removal of constitutional disturbances as far as possible, in the hope that the origin of the reflex impulses to the glands may be eliminated.

If measures are demanded by the dryness of the mucous membrane, the mouth and tongue should be painted or sprayed with liquid albolene or pure glycerin, especially just before food is taken. Strict cleanliness is important. Seifert has given pilocarpin hydrochlorate with some success in starting a flow of saliva. He commences with 5 drops of a 2½ per cent. solution and increases one drop at a time until the desired effect is obtained. Its administration may be continued for weeks and months unless sweats and prostration ensue.

Faradism has been applied to the skin and the glands with some success.

INFLAMMATION OF THE PAROTID GLAND

1. **Specific parotitis** (mumps) is considered in the section upon infectious diseases.

2. **Symptomatic parotitis** occurs in the course of infectious fevers, as pneumonia, general pyogenic infections, and especially typhoid fever. There is another form of parotitis that is not infectious and follows injury or disease of the abdominal organs, particularly of the genito-urinary and gastro-intestinal tracts, including gastric ulcer. In the infectious form the causative agent may be carried to the gland by the blood, or it may enter through Stenson's duct.

The **prophylactic treatment** of the infectious variety consists of strict cleanliness of the mouth to prevent direct infection. When infectious parotitis develops, suppuration usually rapidly supervenes, and the treatment becomes entirely surgical. In the early stages the application of cold and local depletion, as by leeching, may do good, but as soon as the presence of pus is suspected the gland must be incised.

DISEASES OF THE ESOPHAGUS

By Bertram W. Sippy, M.D.

The chief function of the esophagus is to serve as a passageway between the pharynx and stomach. Corresponding to its function, its structure is simple, and diseases of the esophagus, aside from those causing stenosis, are relatively rare and unimportant.

ACUTE ESOPHAGITIS

The esophagus is frequently subjected to mechanical, chemical, and thermal irritants, hence a slight degree of hyperemia bordering on inflammation is of common occurrence. Acute inflammation of such intensity as to cause pronounced symptoms, however, is relatively rare. The most common cause is the ingestion of chemical and corrosive substances. Under ordinary conditions acute inflammation of the stomach, pharynx, larynx, or trachea is seldom transmitted to the esophagus. Acute general diseases and infections are now and then associated with a mild esophagitis. Croupous and necrotic inflammation of the esophagus is recognized as a very rare complication of typhoid fever, cholera, smallpox, measles, scarlet fever, sepsis, and uremia. In such cases there may be a direct extension of the inflammation from the pharynx or larynx. It is noteworthy that diphtheria rarely extends into the esophagus. Phlegmonous inflammation of the esophagus is extremely rare. Foreign bodies arrested in the esophagus may cause pressure necrosis and peri-esophageal abscess formation. Thrush may invade the mucous membrane of the esophagus. As a rule, the infection is found at the same time in the mouth and pharynx. In adults the growth of the micro-organisms is seldom sufficient to cause dysphagia, and is usually associated with such processes as typhoid fever, sepsis, and advanced tuberculosis.

A burning sensation in the esophagus, pain upon swallowing, regurgitation of food, and tenderness on pressure are among the chief symptoms of simple esophagitis. Special etiologic factors and diseases, of which esophagitis is but a complication, influence the symptomatology.

Treatment.—In mild cases of acute esophagitis non-irritating foods, such as milk, cream, soft eggs, and gruels, may be taken. In more severe cases all food and drink should be withheld for a few days, the necessary fluids being supplied in the form of salt solution per rectum. After a few days milk, cream, olive oil, and other bland foods may be given. As a rule, local applications are unnecessary. If swallowing is not particularly painful, one or two ounces of a 5 per cent. suspension of bismuth in water may be advantageously administered two or three times daily. Esophagitis resulting from the swallowing of caustic chemicals may require morphin injections for the relief of pain. If it becomes necessary to give fluids by mouth before the intensity of the inflammation has subsided, some relief from pain on swallowing may be obtained by giving a half teaspoonful of a 1 : 1000 solution of adrenalin containing 1 per cent. cocain just before each feeding. The more intense the inflammation, the greater the danger of subsequent cicatricial stenosis. Particularly in those cases in which corrosive substances have been swallowed, esophageal bougies should be passed as early as a week or ten days afterward. The patient should take a few swallows of olive oil just previous to the passage of the bougie. In severe cases the narrowing may already be so great that only small-sized bougies can be used. In a few days larger sizes should be passed, gradually dilating every three or four days, until the maximum sized esophageal bougie has been passed. This should be accomplished before extensive cicatricial narrowing has had time to develop. If the tissue destruction has been great, it is often necessary to pass a bougie once a month for years.

ULCER OF THE ESOPHAGUS

Esophageal ulcer is not common. Among the causes may be mentioned pressure necrosis, the peptic action of the gastric juice, simple esophagitis, and the chemical action of corrosive substances. Ulcer of the esophagus from tuberculosis, syphilis, and actinomycosis is extremely rare. Follicular ulceration may result from catarrhal inflammation of the mucous glands of the esophagus. This occurs chiefly in the aged. Local ulceration from the irritation of decomposing foods occurs in structure and diverticula of the esophagus. Decubital ulcers may develop in typhoid fever and chronic tuberculosis. A perichondritis of the cricoid cartilage is usually present. The cartilage in contact with the esophagus is often hardened by calcific deposits. This, together with prolonged pressure due to horizontal position and contributory infection, may be sufficient to give rise to local necrosis. Thyroid tumors may press the trachea firmly against the esophagus and cause ulceration. Aneurism may cause pressure necrosis and foreign bodies lodged in the esophagus may cause ulceration.

Peptic Ulcer.—Peptic ulcer of the esophagus is extremely rare. Less than fifty cases have been reported. A gastric ulcer may extend upward into the esophagus. The pure type of esophageal peptic ulcer, however, is confined to the mucous membrane of the esophagus, and occupies without preference any part of its lower third. Normally, the gastric juice is prevented from coming in contact with the esophagus by rather a firm closure of the cardia. Insufficiency of the cardia allows the gastric juice to escape upward into the esophagus, and peptic ulcer may result.

Benign stenosis at the pylorus from gastric ulcer with retention of secretion, inducing more or less vomiting or regurgitation of gastric contents, has been causative of esophageal ulcer. In other cases multiple ulcers of the stomach, duodenum, and esophagus have been observed. Multiple hemorrhagic erosions may have been the cause. The disease is often latent. The chief clinical manifestations are pain, dysphagia, vomiting, regurgitation, and hemorrhage. The ulcer may be demonstrated by the esophagoscope. Healing may take place with or without stenosis.

Tuberculous Ulcer.—In sharp contrast to the pharynx, larynx, large and small intestine, tuberculous ulcer is rarely found in the esophagus or stomach.

Syphilitic ulcer of the esophagus is extremely rare, and only a few cases of **actinomycosis** of the esophagus have been reported.

Treatment.—The treatment of esophageal ulcer does not differ essentially from the medical treatment of gastric ulcer. It is impracticable to apply local remedies by means of the esophagoscope. If nutrition is seriously impaired, or hemorrhage alarming, gastrostomy should be performed and the patient fed through the fistula until the ulcer has healed.

STENOSIS OF THE ESOPHAGUS

Esophageal stenosis is by far the most common condition of the esophagus requiring treatment. Its causes may be extra-esophageal and intra-esophageal. Among the extra-esophageal causes are retropharyngeal growths and swellings, enlarged cervical glands, thyroid and thymus tumors, aneurism, mediastinal tumors, pericardial and pleural exudates, and disease of the vertebræ. The important intra-esophageal causes are cicatricial narrowing, spasm, diverticula, and carcinoma.

Cicatricial Stenosis of the Esophagus

Cicatricial narrowing of the esophagus stands next in frequency to carcinoma as a cause of esophageal stenosis. Its more important causes are the swallowing of caustic acids and alkalies, the healing of esophageal ulcers due to the impaction of coarse food and foreign bodies, peptic action of the gastric juice, and typhoid fever.

Treatment.—During the first week or ten days subsequent to the swallowing of caustic acids or alkalies the esophagus should be given complete rest. Then bougies should be passed at least once or twice each week until the maximum-sized lumen is obtained. This opening should be maintained by using the bougie every few weeks, perhaps for years, as the case may require. If cicatricial narrowing is already present and the stricture is not tortuous, ordinary olive-tipped esophageal bougies may be passed, beginning with a small-sized bulb that may go through without the use of dangerous force. The opening should be cautiously enlarged by using bulbs of gradually increasing size. Pain, hemorrhage, inflammatory reaction, and length of the cicatricial narrowing influence the rapidity with which dilatation should be accomplished. It is impossible to dilate a very tortuous stricture with an ordinary esophageal bougie. In such cases a flexible linen esophageal bougie may be used, but great caution must be exercised, otherwise a false passage may be made. Presumably the point of the flexible bougie follows the tortuous canal, but it may double up and perforate the walls of the esophagus.

To obviate the danger of making false passages in the esophagus by using a bougie without a guide, the writer has devised an esophageal dilator, which he has used in many cases to dilate both cicatricial and carcinomatous strictures of the esophagus. The results have been extremely satisfactory and the danger of causing perforation of the esophagus by passing a dilating instrument is thereby apparently reduced to a minimum. The method is to be recommended particularly in treating tight and tortuous stricture. The principle of using a silk thread as a guide is utilized in the following way: About a yard of a 25-yard spool of braided surgical silk thread, No. 8, is placed in a capsule and swallowed, and gradually one or two yards more is swallowed each day. A silk thread will eventually go through any stricture that will permit the passage of even a small quantity of water. After a few days the thread that was first swallowed becomes deeply anchored in the intestine and later passes out through the rectum. The dilator (Fig. 17) consists of a series of graduated conical metal bulbs (A) that may be screwed on to a very flexible spiral introducer (B) about 22 inches long, made of piano wire, size No. 10. Each conical bulb is provided with a central canal that is continuous with the lumen of the spiral introducer when the bulb is adjusted. The end of the silk thread protruding from the mouth is drawn back from the esophagus until it is moderately taut, and then threaded by means of a wire (C) through the center of the bulb and spiral introducer. By holding the end of the thread firmly in one hand and pushing on the spiral introducer with the other, the very flexible spiral becomes rigid and the conical bulb guided by the thread may be very gently forced through the stricture. The spiral is so flexible that the bulb will follow the thread through very tortuous strictures. Beginning with a bulb that passes with a very easy pressure, slightly larger bulbs should be used in succession until the stricture is sufficiently dilated. Usually an ordinary flexible linen bougie may then be passed safely and the opening through the stricture maintained without the use of the thread.

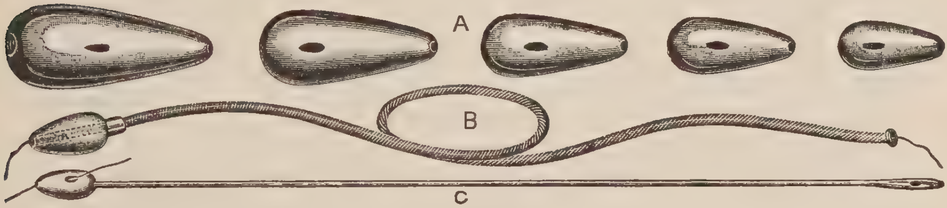

Fig. 17.

In treating esophageal stenosis in very young children, unable to swallow the thread, and in adults with short, tight, and tortuous stricture, the writer has accomplished dilatation by the aid of the esophagoscope. The visible opening through the stricture having been located by the esophagoscope, a filiform whalebone bougie or a bougie made of fine piano wire tipped with small metal bulb may be passed on through the stricture into the stomach. Holding the fine filiform or wire bougie in position, the esophagoscope may be withdrawn, leaving the filiform or wire bougie in position to act as a guide over which dilating bulbs may be threaded.

In treating cicatricial stenosis of the esophagus, it should rarely be necessary to perform gastrostomy for the purpose of feeding the patient, provided the stricture permits the passage of water.

SPASM OF THE ESOPHAGUS

Tonic or intermittent contraction of the muscular fibers of the esophagus, resulting in uncomfortable deglutition, may take place at any point in the esophagus. The following groups of cases may be distinguished:

1. Esophageal spasm occurring as a symptom in well-recognized diseases, such as tetanus, hydrophobia, hysteria, chorea, epilepsy.
2. Esophageal spasm, resulting reflexly from disease located in the esophagus or elsewhere in the body, such as tuberculous ulcers of the larynx, disease of the stomach, peritoneum, and uterus.
3. Esophageal spasm occurring without apparent cause. In such cases ill-defined nervous states are likely to be present. The familiar globus hystericus is said to be due to esophageal spasm.

Spasm of the esophagus rarely causes serious symptoms except when located at the pharyngeal or cardiac orifice. Spasm at the pharyngeal orifice rarely causes serious obstruction. As a rule, it may be overcome by the passage of large-sized bougies. In a case under observation recently no improvement was noted until the orifice was forcibly stretched by the rubber bag dilator described in the treatment of cardiospasm. Spasm of the esophageal muscle occurring at points between the pharyngeal and cardiac orifices seldom requires treatment. If troublesome, the systematic passage of bougies is usually followed by satisfactory results. Bromids may be given advantageously. The underlying condition should be sought and, if possible, removed. Spasm at the cardiac orifice will be discussed under Idiopathic Dilatation of the Esophagus.

IDIOPATHIC DILATATION OF THE ESOPHAGUS: CARDIOSPASM

Dilatation of the esophagus arising independently of obstruction by an anatomic narrowing of its lumen was first described by Purton, in 1821. In 1874 Ziemssen and Zenker collected from the literature seventeen cases. The early cases reported were discovered post-mortem. Recently the disease has been recognized ante-mortem and has been treated successfully. Although fifteen years ago so-called idiopathic dilatation of the esophagus was looked upon as rare, chiefly of pathologic interest, and scarcely to be diagnosed ante-mortem, we now know that the condition is undoubtedly not rare and sufficiently grave to demand a more wide-spread knowledge of its manifestations and treatment. The writer has recognized and treated thirty-nine cases since 1903.

Etiology.—The following factors are recognized as contributing to the development of so-called idiopathic dilatation of the esophagus: (1) Primary cardiospasm (Mikulicz and Meltzer); (2) primary atony of the musculature of the esophagus (Rosenheim); (3) simultaneous development of cardiospasm and paresis of the musculature of the esophagus due to anatomic or functional disease of the pneumogastric nerve (Kraus); (4) congenital malformations (Fleiner); (5) primary esophagitis (Martin).

Very probably the greatest number of cases develop as a result of primary spasm or failure of the normal automatic relaxation of the circular muscles at the cardiac orifice of the esophagus. Nervous, psychic, and emotional disturbances play an important rôle in the development of the condition. Such influences as blows on the chest, the swallowing of chemical and thermal irritants, and infectious diseases, as pneumonia, have been among the exciting causes.

Anatomically, two forms of idiopathic dilatation of the esophagus may be distinguished: (1) Fusiform dilatation with marked hypertrophy of the muscle wall of the esophagus; (2) dilatation with slight or no hypertrophy of the esophageal muscle.

The first is the common form. The second is favored by atony of the muscle wall and a rapid accumulation of food, stretching the esophagus before muscular hypertrophy has had time to develop.

The degree of dilatation varies, being greatest when the esophageal wall is atonic. The capacity of the normal esophagus is about 100 c.c. Kennicut recently demonstrated a specimen in which the capacity of the dilated esophagus was 1800 c.c. In the majority of cases the capacity of the dilated esophagus does not exceed 500 or 600 c.c. In a fatal case observed by the writer the dilated esophagus held 500 c.c. The hypertrophied muscle was 9 mm. thick. The normal thickness of the muscle of the esophagus varies from 1 to 2.5 mm.

The dilatation terminates below at a point 3 or 4 cm. above the cardiac orifice of the stomach. The seat of the greatest dilatation is in the lower third of the esophagus. The muscular hypertrophy is practically confined to the dilated sac, little or no hypertrophy being evident at the point where the spasmodic stricture exists. The mucous membrane of the dilated esophagus may become inflamed and eroded from the stagnation of food, thus causing reflex spasm at the cardia and retarding recovery.

Diagnostic Aids.—Nearly all of the usual signs of esophageal obstruction from organic stricture are present. The following peculiarities, however, may be observed in stenosis due to cardiospasm: (1) Great fluctuation in the course of the disease; years may elapse before emaciation appears. (2) Difficulty in swallowing liquids may be greater and appear earlier than the difficulty in swallowing solids. (3) The degree of dilatation of the esophagus may be much greater than that which occurs from organic stricture. (4) The obstruction to the passage of liquids is more complete than that caused by organic stricture. It may be possible to aspirate from 100 to 600 c.c. from the esophagus hours after the liquid is swallowed. Except when spasm or acute inflammatory swelling complicates an organic stricture, a sufficient opening is practically always present to allow liquids to trickle through. (5) Upon passing a stomach-tube or large-sized bougie, it may be temporarily arrested at the cardia and then passed on into the stomach. In some cases there is no obstruction to the passage of the bougie, although food and liquids are retained in the esophagus.

The onset may be sudden or gradual. In most cases the first symptom noted is discomfort or real pain located beneath the lower part of the sternum, occurring during the ingestion of food or drink. A choking sensation causes the patient to eat slowly. In mild cases there may be no other symptoms and the condition may disappear without further development. In the more serious cases regurgitation of food and mucus takes place and starvation is threatened. Finally, death may result, if the obstruction is not relieved. The earlier the condition is recognized, the more favorable the prognosis. After dilatation of the esophagus has taken place, it is improbable that it ever regains its normal size. Even if the spasm is relieved, food is likely to lodge on the sides of the fusiform cavity and favor reflex spasm of the cardia and a return of the obstruction. Symptoms of the disorder have continued for twenty years. Other cases have advanced to a fatal termination in two or three years.

Treatment.—In mild cases it may be sufficient to give a soft, mushy diet, combined with bodily and mental rest. Food should be taken slowly. Chemical, mechanical, and thermal irritants should be avoided. Bromids may aid in controlling the spasm. Olive oil soothes the inflamed mucous membrane. In some cases the systematic use of the bougie is followed by good results. If the mucous membrane is inflamed, eroded, or ulcerated, the bougie is likely to cause an increase in the spasm. Hence, if possible, the esophagoscope should be used before attempting to relieve the condition by bougies. To overstretch the muscular fibers at the seat of the spasm is the best treatment as yet devised. While large bougies give temporary relief in some cases, no actual stretching of the cardiac orifice is accomplished. Rubber bags have been introduced into the stricture and inflated with some degree of success. The principle of the urethral dilator has been utilized and long instruments constructed by which dilatation has been accomplished. Mikulicz conceived the idea of making an opening into the stomach and then forcibly stretching the cardia from below by means of an instrument acting in the manner of a uterine dilator. The success obtained by Mikulicz in the four cases thus treated by him has led others to adopt the same method. While the procedure is not particularly difficult or dangerous, it must be classed among the major operations, and is no longer justified.

In 1903* the writer devised a rubber bag dilator, by means of which the same degree of dilatation may be obtained without subjecting the patient to the risk of a serious surgical operation. An anesthetic is not required and the discomfort is little more than that which attends the passage of a bougie. If desired, the dilatation may be accomplished under the influence of laughing gas. The instrument (see Fig. 18) consists of a thin rubber bag, 4 inches long, and 1½ inches wide, when collapsed. At an upper corner of the bag a firm piece of rubber tubing, about 20 inches long, is attached. Another piece of tubing, 3 inches long, is secured in the center of the rubber bag. A special introducer, A, fits into this compartment and guides the bag to the seat of the stricture. A thin firm silk sack, 5 inches long and 2 to 2½ inches wide, surrounds the rubber bag. When distended with air, a firm cylinder is produced, which is about 4 inches long and 4 to 5 inches in circumference, when distended to the extreme limit. An ordinary rubber condom protects the silk sack from becoming soiled and prevents friction when the instrument is introduced. When collapsed, ready for introduction, the diameter of the instrument is much less than that of an ordinary stomach-tube. The bag is readily guided into the stricture and the degree of lateral pressure exerted by the bag is accurately measured by connecting the dilator with an ordinary clinical blood-pressure apparatus. Water pressure may be substituted for air pressure, if desired, by connecting the rubber tubing to a fountain syringe or an irrigator. The amount of pressure required to overstretch the thin muscle at the cardiac orifice is small. If using a clinical blood-pressure apparatus, pressure sufficient to lift the mercury to 100 or 150 mm. is ample, and should be safe, if no complaint of pain is made. If water pressure is used, the irrigator should not be more than 5 or 7 feet above the position of the cardiac orifice. Extreme caution must be used, as the esophagus has been ruptured by such simple acts as vomiting and the passage of an ordinary stomach-tube. The larger the circumference of the dilating bag, the greater the degree of the lateral pressure exerted, hence it is important that the silk bag covering which limits the extent to which the esophagus

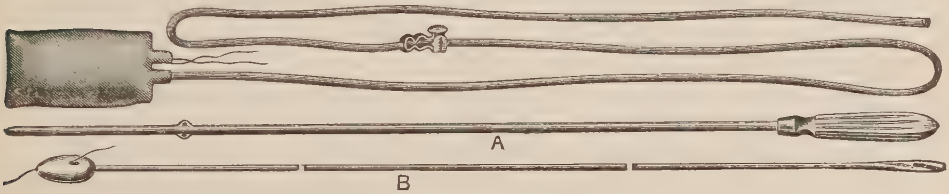

Fig. 18.

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* Since that time Plummer and others have devised excellent dilating bags, similar in principle.

may be stretched does not exceed a circumference of 4 or 4½ inches in adults, until it is demonstrated that a greater degree of dilatation is necessary or permissible.

Direct inspection of the tissue to be dilated, by means of the esophagoscope, should precede the use of even the moderate degree of forcible dilatation described. In rare cases, particularly in those in which sacculation is great, the walls relaxed and perhaps atonic, the ordinary introducer may become arrested in the bottom of the sack and does not find its way through the cardiac orifice. To obviate this the writer has made use of the silk thread as a guide, and substituted his spiral introducer (see Fig. 17), and then has had no difficulty in placing the bar accurately at any point desired. The pharynx should be cocainized to prevent the tendency to vomit while using the instrument. The procedure should not be painful. The effect of the dilatation should be tested at once after dilatation has been accomplished. The patient is able to swallow perfectly, as soon as the cardiac orifice has been sufficiently stretched. As a rule, the requisite dilatation in an adult is reached by using a silk bag covering, the circumference of which is about 5 inches, the bag distended with air at a pressure of 150 mm. of mercury, or 7 feet of water pressure. One good stretching may suffice for years. Of thirty-eight cases dilated by the writer there have been only four recurrences requiring second dilatation. One required three separate dilatations. The procedure is almost as simple as the passage of the bougie. It is advisable to treat the mild cases also by overstretching, for the purpose of preventing dilatation, and the resulting organic changes that may predispose to a return of the condition.

No special after-treatment is required. A bland, non-irritating diet should be recommended and nervous strain avoided.

DIVERTICULA OF THE ESOPHAGUS

An esophageal diverticulum is a pouch-shaped sacculation involving a limited portion only of the circumference of the esophagus. The condition is sharply differentiated from dilatation of the esophagus, in which the entire circumference of the tube is involved. The wall of the pouch usually consists of mucous membrane and connective tissue, the muscular coat of the esophagus having been either destroyed or pushed aside. The mucous membrane of the sac is usually only slightly altered. Deep erosion or ulceration is rare. Carcinoma may develop as a result of local irritation. According to the manner in which the pouch-like sacculation develops, three types are recognized: Pressure or pulsion diverticula, traction diverticula, and traction-pressure or traction-pulsion diverticula.

Pressure diverticula, though less common than traction diverticula, are of much greater clinical interest. They may be located (1) in the pharynx; (2) at the junction of the pharynx and esophagus; (3) near the bifurcation of the trachea, usually just above the left bronchus; (4) below the level of the left bronchus. These are usually deep-seated, having their origin in the lower part of the esophagus, the sac resting upon the diaphragm. Congenital defects may contribute to the development of a pressure diverticulum. A large bolus of food may lodge in the pharynx or esophagus, and cause a slight stretching or bulging of a circumscribed area. Subsequently food may accumulate at this point, exerting pressure and finally causing the formation of a pouch. The most common and important pressure diverticula develop at the junction of the pharynx and esophagus. The capacity of the pouch of a pharyngo-esophageal diverticulum varies from a few cubic centimeters to two hundred and fifty and more. They usually originate in the median line posteriorly. As the pouch develops, it usually pushes the esophagus aside and occupies a left lateral position.

Owing to pressure exerted by the left bronchus against the esophagus, food may lodge on the wall of the esophagus just above the bronchus and cause sacculation.

Diverticula of the lower part of the esophagus usually develop from the anterior or lateral wall. Their etiology is obscure, although some are surely of the traction-pressure variety.

Traction diverticula are very common. The local bulging is nearly always due to contraction of scar tissue attached to the outer surface of the esophagus. The cicatrix usually arises from inflammation of bronchial lymph-glands in the vicinity of the bifurcation of the trachea. Hence, traction diverticula are frequent in tuberculous subjects. They are usually funnel-shaped, and remain small provided the mouth of the pouch is lower than its cavity, thus preventing the accumulation of food. As a rule, traction diverticula produce no symptoms except when associated with suppurative processes. Rupture may then take place into the surrounding organs, as trachea, bronchi, pleura, and blood-vessels, with disastrous results.

A **traction-pressure diverticulum** may develop when the orifice and sac of a traction diverticulum favor the entrance and accumulation of food. A traction-pressure diverticulum may become large and correspondingly serious.

Course.—Symptoms of importance rarely develop before the age of fifty, except when the condition originates from a congenital stenosis of the esophagus. For years the patient may be conscious that food lodges at a certain point in the esophagus. Symptoms similar to those of a gradually increasing stenosis may subsequently appear and slowly develop, until finally death from starvation or intercurrent disease takes place unless the condition is relieved.

Treatment.—If the condition develops late in life and little or no hindrance to the passage of food is present, the patient should be directed to eat slowly and avoid coarse foods. Appearing thus late in life, even though it is impossible to pass a tube into the stomach, serious symptoms may never develop. If food stagnates sufficiently to cause irritation, the pouch should be irrigated once or twice daily with permanganate solution.

If the sac does not contain lactic acid or a large number of leukocytes, it is not necessary to irrigate. If serious difficulty begins earlier in life, the trouble is likely to cause death, unless more active measures are instituted. Pharyngeal and pharyngo-esophageal diverticula may be removed or otherwise relieved by surgical operation in properly selected cases.

Diverticula having their origin below the sternum cannot be removed. Such cases, together with those that are otherwise inoperable, may become very serious, provided the pouch is so situated that it fills with food and crowds over against the esophagus in such a way as to prevent the entrance of food into the stomach. At times the position assumed by the patient while eating and drinking influences greatly the permeability of the obstruction.

Many different lateral and other positions should be faithfully tried until the one most favorable to swallowing is found. In some cases swallowing is best accomplished when the stomach is higher than the mouth, so that food and drink are forced upward entirely by peristaltic action. If starvation threatens, it may be possible to pass hollow bougies, curved at the end like a Mercier catheter, and feed through the bougie. By the aid of the esophagoscope it may be possible to find the opening of the esophagus distal to the pouch, and by the aid of specially constructed instruments depress the partition between the pouch and the esophagus in such a way as to favor emptying of the pouch. In most cases, however, it is impossible to find the place where the pouch communicates with the esophagus by the use of the esophagoscope alone. Again, the silk thread used in the manner advised for dilating esophageal strictures becomes of inestimable value. The thread when swallowed will pass on into the stomach in a reasonable time and serve as an accurate guide into the esophagus beyond the pouch, and may be used by an experienced operator in many ways to overcome the difficulties presented in individual cases. By using the thread as a guide the diverticulum sound of Leube becomes unnecessary. In very rare cases it may become necessary to do gastrostomy.

CARCINOMA OF THE ESOPHAGUS

The esophagus ranks about fifth in frequency among the organs that become the seat of carcinoma. The growths are distributed approximately as follows: Fifty per cent. near the lower end of the esophagus, chiefly where the esophagus passes through the diaphragm and at the cardiac orifice. Forty per cent. at or near the bifurcation of the trachea. Ten per cent. in the cervical portion of the esophagus. Added to the usual malignant features of carcinoma elsewhere, the special dangers are death from starvation due to esophageal obstruction, and perforation of the lungs, bronchial tubes, blood-vessels, and mediastinal tissue through ulceration of the growth.

Although carcinoma is the most frequent cause of esophageal stenosis in adults, serious error will be avoided by making an intelligent attempt to exclude every other cause before concluding that carcinoma is responsible for the obstruction. Many deaths from starvation have occurred from simply assuming upon insufficient evidence that malignant disease was causing the obstruction.

The surgical treatment of esophageal carcinoma is confined to resection, esophagostomy, and gastrostomy. Only a relatively small number of the growths are located in the cervical region where they are accessible to radical operation. The tissue in the neighborhood of the esophagus offers little resistance to the character of infection that is likely to develop when the esophagus is opened, hence resection of the growth and esophagostomy are seldom performed.

Gastrostomy is the common surgical operation justified. Owing to the uncomfortable mental and physical state of the patient following gastrostomy, the operation is seldom justified, as long as the lumen of the esophagus is large enough to permit adequate liquid nourishment to be taken. The patient should be instructed to eat slowly and avoid coarse and irritating foods. If the obstruction is not great, a large variety of foods may be permitted. As the difficulty in swallowing increases, the diet should be limited to vegetable purées, milk, cream, nourishing soups, soft eggs, egg-nog, and similar liquid or semi-solid foods.

In selected cases the passage of soft, flexible, dilating bougies about once a week, in order to keep the lumen of the esophagus from growing smaller, is justified. Great care should be exercised and no force used, since the carcinomatous tissue is often very friable and the wall of the esophagus may be perforated. A carcinomatous stricture often presents a very tortuous canal. The danger of attempting to pass a bougie through such a stricture without something to guide the point of the bougie is very apparent. The writer has used the silk thread as a guide and the hollow spiral bougie already described for use in dilating cicatricial strictures, with very satisfactory results in many cases.

In selected cases the writer has also passed a small piano-wire bougie through the stricture into the stomach and then used the wire as a guide for the dilating spiral bougie.

It should be remembered that the dilatation must be accomplished slowly and without force. In most cases by careful management it will be possible to maintain an opening sufficiently large to permit an adequate quantity of nourishing fluids to enter the stomach until very late in the disease. Pain is seldom severe enough to require morphin. As the obstruction increases, the difficulty in swallowing may fluctuate greatly, on account of inflammatory swelling. The swelling frequently subsides upon giving no food by mouth for two or three days. Saline solution should be given per rectum to supply the necessary fluids. Twenty drops of a 1 : 1000 solution of adrenalin in a teaspoonful of a 1 per cent. cocain solution, taken a short time before liquid food is given, may reduce the swelling and thus temporarily facilitate swallowing.

When no contraindication exists, gastrostomy may be indicated in cases that show a tendency to high-grade obstruction early in the course of the disease, or when the passage of a bougie is particularly difficult and dangerous, or is associated with unusual inflammatory reaction or serious hemorrhage. The operation may also be performed when perforation into a bronchus occurs, although death from pneumonia is likely to follow such a complication quickly.

SURGERY OF THE ESOPHAGUS

By Charles H. Mayo, A.M., M.D., LL.D.

The esophagus extends from the pharynx opposite the sixth cervical vertebra and the lower border of the cricoid cartilage, to the stomach ¾ of an inch below the diaphragm, a distance of from 9 to 10 inches in the average adult male. It is 6 inches from the teeth to the beginning of the esophagus, making in all from 14 to 16 inches from the teeth to the cardiac orifice of the stomach. There are three normal narrowings of the esophagus: (1) at its beginning at the cricoid cartilage, (2) near its middle at the bifurcation of the trachea, and (3) at the diaphragmatic opening. Along its course in the neck it is somewhat more easily accessible from the left side, and the opening through the diaphragm is about 1½ inches to the left of the middle line and 4 inches posterior to the anterior chest-wall. Its greatest diameter is transverse.

The function of the esophagus is almost purely that of a feeding-tube, and nearly all of the complications with which the surgeon is concerned arise through interference with the swallowing function (propulsion).

METHODS OF EXAMINATION

The history of the patient is of great importance in furnishing a clue as to the probable cause of the difficulty in swallowing, and the regurgitation of food, which are the most common symptoms. Data will be obtained frequently of the swallowing of acids and alkalines by children, which causes stricture; of swallowing a foreign body, which is followed by immediate obstruction; of long-standing symptoms in the adult which lead to a search for cardiospasm or diverticula, and of the shorter histories of constantly increasing obstruction due to malignancy. The clinical examination must be the determining factor as to the presence and the location of pockets, dilatations, strictures, and the character of the esophageal wall.

Some of the various methods which have proved of especial value in the diagnosis of these conditions are as follows: The numerous methods of sounding; röntgenography and esophagoscopy. The *x*-ray showing a tumor in proximity to the esophagus which causes pressure obstruction, also shows large tumors of the esophagus and foreign bodies. Radiograms, after giving acacia and bismuth mixture, will show the various dilatations caused by strictures and cardiospasm, and will also show pockets or diverticula. The fluoroscope picture is often a valuable aid in discovering foreign bodies, and very often their removal is facilitated by the direct observation during the manipulation of the instruments.

In the routine examination of adult patients a soft stomach-tube is introduced, and usually the point of obstruction can be located at once. A marked dilatation of the esophagus may occur in cardiospasm, as shown by capacity measurement and radiograph, and yet may occasionally allow the stomach-tube to pass without appreciable obstruction. In examining children a soft catheter can be used; following this flexible bougies (preferably of whalebone) with various sizes of bulbs to locate the position and size as well as the number of obstructions.

In favorable cases the upper end of the esophagus may be exposed by introducing the finger. The gagging induced by this procedure elevates the glottis and renders it easier to guide the forceps for use in the upper portion of the esophagus. Since success in esophageal treatment depends upon one's ability to pass instruments through it, every effort should be made to accomplish this procedure in cases of obstruction without using force, which might cause a perforation into the mediastinal or abdominal space—a very serious and usually a fatal accident from mediastinal or peritoneal infection.

STRICTURE

Benign stenosis is usually due to the cicatrix which follows healing of an ulceration. Such ulcerations, as has been noted, are more commonly due to swallowing corrosive substances, and as a result of spasm of the esophagus there is a tendency for these ulcerations and resulting strictures to remain more or less localized at one or more points in the esophagus.

Dilatation in the treatment of these cases of cicatricial stenosis is of prime importance, and, if necessary, should be continued for months or years. The passage of bougies should begin early, following escharotics, without waiting for complete healing to take place. In some cases of obstruction from cicatricial stenosis a number of fine filiform probes, such as are used in urethral work, may be instrumental in discovering the passage. In some instances, however, it is safer to use the Dunham method, *i. e.*, having the patient swallow several yards of silk-twist which will snarl up above the stricture, and after a time some portion of it will pass through into the stomach, where, formerly, it was searched for through a gastrotomy opening, and by the Abbe method of thread sawing and by drawing beads through the stricture enlarging the lumen sufficiently to enable sounding. Mixter has demonstrated that by giving the thread more time it will pass into the intestine far enough to permit considerable traction upon the upper portion, thus eliminating the gastrotomy procedure. By having metallic bulbs made with an opening through the point and out at the side, through which the thread is passed, perfectly controlled dilating may be effected (Dunham method). In some instances a fine piano-wire with a small loop at the end is passed down the thread, and various instruments are introduced with the aid of this more rigid guide. By fastening a second string to the end of the piano-wire, a string bow is made which may be used to saw a stricture; this is similar in action to the Abbe string-saw. In rare instances Dunham's esophagotome will be found useful in cutting strictures.

Retrograde dilatation of stricture by opening the stomach is rarely necessary, but the method has been employed by Wilms, Richardson, and others. When it is necessary to open the stomach in esophageal cases, the Stamm-Kader method of gastrostomy is chosen, as it affords direct access to the stomach for later manipulation, and is reliable against leakage.

CARDIOSPASM

The so-called "idiopathic" dilatation of the esophagus was noted by von Ziemssen and Zenker in 1878, from collected reports of post-mortem findings. Later the symptomatology assumed importance as it developed from the investigations of Lichtenstein, von Strümpell, Meltzer, Rumpel, Kraus, Rosenheim, Fleiner, Ewald, Netter, Kelling, Einhorn, Martin, Oppler, Gottstein, Dauber, Zausch, Strauss, Lossen, Sippy, Plummer, and others.

Several hundred cases of cardiospasm have been reported. Spasm in these cases undoubtedly precedes dilatation, although the occasional case does not show its presence at the time of examination. Some cases, indeed, show a marked periodicity of the condition; in other cases the natural angulation of the lower esophagus where it passes through the diaphragm is greatly increased—a condition possibly made worse by spasm and dilatation.

It is difficult to determine the cause of the condition in most instances, but in some cases it seems to be due to direct irritation of ulcer fissures, or to new-growths.

The average age of the individual at the onset of symptoms is about thirty years. The stages of the condition are rather clearly defined as follows: (1) The muscular power of the esophagus is sufficient to force food through the spastic area into the stomach, causing some discomfort, pain, and choking. The spells may be periodic. (2) Immediate regurgitation of food as the power of the muscle becomes insufficient to force it onward. The spells are more continuous. (3) The esophagus rapidly dilates and is characterized by food retention which is regurgitated at irregular intervals.

Plummer divides the diagnostic points to be demonstrated into four groups: (1) The food is regurgitated from the esophagus and not from the stomach. (2) The existence and character of the obstruction at the cardia. (3) The presence or absence of esophageal dilatation, and its size, shape, etc. (4) The presence or absence of gross lesions in the esophagus or neighboring organs which might excite the cardiospasm.

If the stomach-tube fails to pass a cardia which has readily passed an olive, possible cardiospasm is indicated.

In four of our earlier cases of cardiospasm we found it necessary to make a gastrostomy for nourishment. In three of the cases the cause of the cardiac stenosis was not recognized at the time of the operation.

Mikulicz dilated four cases of cardiospasm with a glove-stretcher through a gastrotomy, with immediate cure. Erdmann reports a successful case by this method, and one of our series was relieved in the same manner.

Russell was the first to report a sufficient number of cases of cardiospasm cured by dilating with the silk-covered rubber balloon inserted on a staff to demonstrate its value. Plummer has had a remarkable series of eighty cases cured by this method of treatment.

FOREIGN BODIES

One of the most common surgical conditions of the esophagus is the accidental lodgment of foreign bodies. In children, particularly, coins, which are frequently carried in the mouth, are swallowed and lodged in the esophagus. Lodgment of peach-stones and of buckles of various kinds is also quite common. In elderly people portions of plates of teeth are perhaps the most frequent cause of obstruction. The patient will usually make the diagnosis. It sometimes happens that although the foreign body has passed into the stomach, so much irritation has been set up during its passage that the patient still believes it to be present in the esophagus. It is very important, before making an effort to remove such bodies, that one should know their nature, and also if there be any sharp points or angles which may cause injury during their removal. Angular bodies, such as plates of teeth, must be carefully noted before an effort is made to remove them. The radiograph is particularly useful for this purpose. In several cases we have been able, with the aid of the fluoroscope, to grasp the foreign body accurately with an alligator-jaw forceps and remove it under direct inspection. In forceps extraction one may take advantage of the increased transverse diameter of the esophagus.

A number of esophagoscopes have been invented for removing foreign bodies from the esophagus, and for the examination of tumors and securing portions of tumors for microscopic examination. Brunning's modification of the Killian instrument is very useful because of its telescoping arrangement. In securing the specimens from tumor growths it should be remembered that in 35 per cent. of cancers in the esophagus the mucous membrane is intact at the lowest point which can be observed. The modern esophageal instruments have so greatly facilitated the removal of foreign bodies from the esophagus that the gastrotomy and string-methods of retrograde removal, as recommended by Finney and Bull, are now rarely employed. The Graefe coin-catching and sponge-probing methods are still of occasional value in the removal of foreign bodies of proper shape.

ESOPHAGOTOMY

The cervical portion of the esophagus can be reached by an external esophageal opening, which is usually made on the left side of the neck and through an incision along the anterior border of the sternomastoid muscle, from the level of the cricoid cartilage to a point near the sternum, the thyroid gland, the sternohyoid, and the thyroid muscles are drawn inward. It may be necessary occasionally to ligate one or both of the thyroid vessels and the lateral thyroid vein. Blunt dissection renders the exposure of the esophagus nearly a bloodless procedure. The curved urethral sound used through the mouth is employed to elevate the esophagus from behind the trachea into the incision. Through this incision exploration can be made to a point considerably below the upper part of the sternum. The esophageal opening is closed by chromic-gut sutures which invert the mucosa. The external wound is drained with folded rubber tissue and gauze for a few days, the incision being allowed to granulate.

External esophagotomy should be usually performed on the left side of the neck. Occasionally, however, it is of great importance that the right-sided incision should be employed. In one case under our observation a child had swallowed a vest-buckle, which became impacted just behind the sternum. Radiograph showed the buckle to be open, the loop pointing to the right. Incision on this side enabled easy removal, while if it had been made on the left side, attempts at extraction would have caused the prongs to pierce the tissues.

ULCERATION

It is hardly necessary to do more than mention those forms of ulceration due to infective granulomata, syphilis, tuberculosis, and actinomycosis. The most common form of benign ulceration is caused by swallowing corrosive substances. Concentrated lye has been the agent in a very large percentage of cases in children. Peptic ulcer has occasionally been found in the esophagus, and a few cases have been reported in which typhoid ulcer was present, or, possibly, it would be more correct to say that ulcer has occurred in the lower esophagus during the course of typhoid fever. Cicatrices following such types of ulceration are rarely the cause of stenosis. Cancer is the most frequent form of ulceration.

CARCINOMA

Carcinoma in the upper portion of the esophagus, when not too extensive or general in its involvement, is removed best by resection. Arbuthnot Lane has utilized skin-flaps with pedicles which were secured from adjacent positions of the neck to turn into the esophagus and replace excised areas. At a second operation the pedicle is separated and the external wound closed.

In some cases of nearly impervious obstruction due to cancer Simmons' rubber tubes are inserted in the stricture and left for permanent drainage. Mixter, especially, reports favorably upon the use of these tubes.

Esophagostrostomy and Intrathoracic Resection of the Esophagus.—At the present time cancers in the thoracic and lower portions of the esophagus are practically inoperable, although the work of Sauerbruch and Brauer and of Willy Meyer with positive or negative pressure cabinet methods of giving anesthesia, which prevent collapse of the lungs, has done much to develop the surgery of the mediastinal space. The principle of the operation as developed by Willy Meyer is to resect a portion of the esophagus and close both ends, depending upon a gastrostomy for feeding; or, to excise a portion of the esophagus at its lower end, and, drawing a fold of the stomach through an opening made in the diaphragm, unite the proximal end of the esophagus to it.

DIVERTICULA

Diverticula or pockets which occur along the esophagus and lower pharynx, although somewhat rare, are so great a menace to health when they do occur that their early recognition is of the utmost importance.

In 1840 Rokitansky described and made two classifications of diverticula of the esophagus. Those developing from internal pressure he termed "pulsion or pressure sacs"; the variety originating from the scar or contraction of inflammatory processes adjacent to the canal, "traction sacs." The "traction" sacs were usually produced by infections involving glands about the left bronchus; they give very few symptoms during life and seldom concern the surgeon, as they are usually found only at autopsy.

The greater number of diverticula of the esophagus are of the pharyngo-esophageal type, and are found in the lower pharynx or upper esophagus, because at this point, sometimes called the "Lannier-Hackerman area," there is a natural deficiency of muscular support where the pharynx merges into the esophagus, particularly on the posterior side. In this region also, through anomaly of development in closure of the lower branchial clefts, conditions occur which favor the development of diverticula. Only a few cases have been reported as being found in the middle and lower third of the canal. The narrowest part of the esophagus is at a point opposite the cricoid which measures, by bougie, 5 or 6 inches from the incisor teeth. Naturally there is increased pressure above this point in swallowing. A mucous pocket between the muscle-fibers may project here, and, once started, it mechanically increases all of the conditions which caused the difficulty originally.

Diverticulum is a condition which is confined to adult life and gives practically no symptoms until difficulty in swallowing is experienced, when a cough may occur from nerve irritation, and pressure from behind the trachea will often cause coincident dyspnea. Cardiospasm may produce much the same difficulty in swallowing, with eructation of food after dilatation has occurred, yet in some cases a stomach-tube may be readily passed in this condition. Stricture obstructs the passage of food, and the onset of the condition being slow may result in some dilatation above it, with food regurgitation. The depth of the obstruction can be measured with a stomach-tube, bougie, or acorn probe, and passable strictures may be dilated by means of the probe. These soundings and measurements do not, however, differentiate between diverticula and strictures which are pervious to liquids and yet impassable to sounds. As a rule, the larger diverticula appear as an extension of the proximal canal, the distal esophagus opening in front above the entrance to the sac. However, traction by distention may drag the opening to a lower level.

A large diverticulum distended by eating has the appearance of a tumor in the neck, and pressure upon this tumor will force the contents back into the pharynx. In these cases tubes and probes pass to the bottom of the sac, although in the early stages of the condition they often pass without obstruction into the stomach.

In making a thorough examination of the esophagus, credit should be given the esophagoscope for its usefulness in cases of obstruction, and especially in removing portions of growths for microscopic examination; however, the procedure requires practice to make it of practical value as a means of diagnosis. Rumpel's multiple tubes and liquids as a method of diagnosis are of value only in exceptional cases. Radiographs, obtained after filling the sac with bismuth and acacia mixture (Figs. 19 and 20), are of marked value in indicating the size, shape, and location of the pocket. The modifications of the method of skiagraph, that of swallowing a chain or inserting a shot-filled tube, are of less practical value. The same can be said of the Strauss method of measuring the capacity of dilatations and diverticula by passing collapsed balloons fastened upon stomach-tubes to be filled with a measured quantity of air.

In examining cases for diverticula Plummer has made use of the Dunham and Mixter method of swallowed thread. He threads the Dunham perforated probe on the string, passes the instrument down the esophagus, and while holding the string loosely the probe passes to the bottom of the pouch, which is always continuous with the upper part of the esophagus. By drawing the string taut and steadying the sound it is elevated to the level of the opening into the lower esophagus, and may then be pushed down the taut string into the stomach. When the string is drawn upon, the amount of elevation secured measures the depth of the pocket. The exact location of the opening is at the end of the probe at the point the elevation ceases.

Operation.—The operative procedures have been quite simple in all but two of our cases, which required subsequent closure of fistulæ. Incision is made along the inner margin of the sternomastoid muscle, which is tracted outward; the anterior sternal neck muscles are drawn inward. The lobe of the thyroid is now elevated and the lateral thyroid vein ligated and cut. The sac can usually be identified, but should any doubt exist, a urethral sound can be passed down the pharynx and its point used to elevate the sac into the wound. Care must be used to preserve the recurrent laryngeal nerve from injury. The sac is opened and an examination made of its interior; it is then amputated and the wound closed by a continuous mattress suture, like an intestinal opening (mucosa inside), and a Cushing parallel suture of fine catgut is inserted to reinforce the closure. The wound is

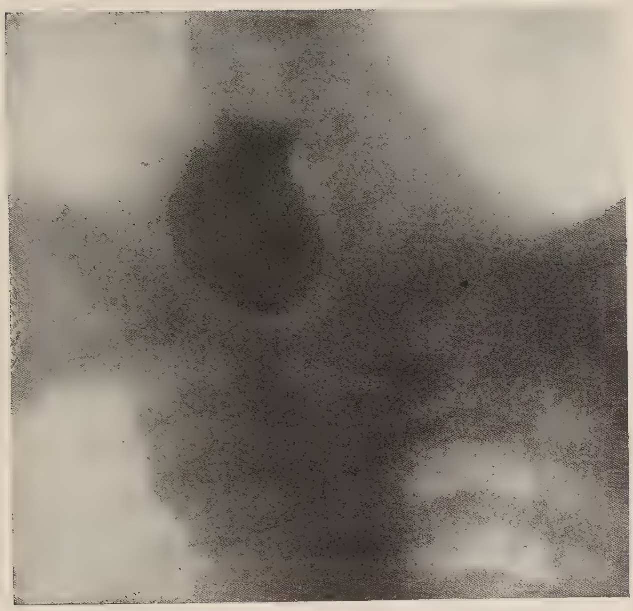

Fig. 19.—Diverticulum of esophagus, from skiagraph (Plummer).

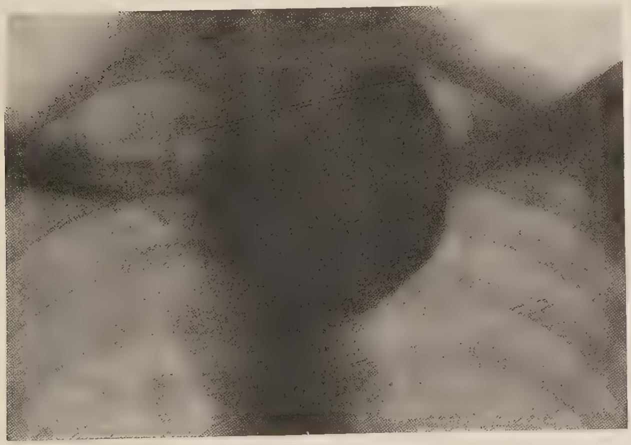

Fig. 20.—Diverticulum of esophagus, from skiagraph (Plummer).

washed with a weak solution of iodin and a temporary drain of rubber tissue is inserted. In one of our cases the contents of a very large sac was forced into the pharynx during operation and a considerable quantity of the material was inspired into the lungs. The raised head of the table was lowered immediately and the fluid escaped into the mouth. Fortunately no harm was done, but the accident pointed out the necessity of emptying a large sac before operation. In this and one other similar case the diverticulum was so large that it extended far into the mediastinal space, and the operation was divided into two stages. To avoid the infection of such a large space the empty sac was drawn out of the neck and ligated. Closure of the short-stump fistula was accomplished later by passing a thread through the mouth and out of the fistula by means of an eyelet sound. The fistula was separated, the thread attached to it, and the short tract in verted into the pharynx, applying three separate circular sutures as it became inverted. The external wound healed quickly. Diverticula are sometimes treated in this manner without opening them externally. Five cases were treated by amputation of sac and immediate suture; all healed without leakage.

In the after-care a large quantity of fluid saline is given by slow enemas, and patients are fed twice a day by passing a small stomach-tube. Sips of hot water are permitted at rare intervals on the second day.

Ten cases of esophageal diverticula have been diagnosed in the clinic at St. Mary's Hospital, and eight were operated upon without mortality; perfect relief followed. Two were not operated.

Since the excellent description of esophageal diverticula given us by Rokitansky, many other articles descriptive of the condition have been written. The contributions of Zenker,* A. E. Halstead,† and DeWitt Stetten‡ are all interesting reviews of the subject, and they furnish extensive bibliography.

*Zenker: Ziemssen Encyclopedia.

†Halstead, A. E.: Annals of Surgery, Feb., 1904.

‡Stetten, DeWitt: Annals of Surgery, March, 1910.

DISEASES OF THE STOMACH

By Bertram W. Sippy, M.D.

ACUTE GASTRITIS

Three forms of acute gastritis may be distinguished: simple, toxic, and phlegmonous. These somewhat arbitrary divisions are based on differences in etiology and severity of anatomic process.

Acute Simple Gastritis

Etiology.—The disease may be primary or secondary.

Primary acute simple gastritis may result from the ingestion of mechanical, chemical, and thermal irritants. Mechanical irritation may result from eating coarse foods rapidly and in large quantity. Chemical irritants, such as sharp condiments, alcohol, caustic alkalies and acids, and metallic salts, and food and drink that has undergone putrefactive decomposition, may give rise to acute gastritis. Excessively hot or cold food and drink may contribute to an acute gastritis. It is well to bear in mind that the discomfort which often follows slight irregularities in eating, drinking, or smoking, so commonly attributed to an acute gastritis, is much more frequently the expression of a temporary hyperchlorhydria. Primary acute simple gastritis is relatively rare.

Secondary acute simple gastritis may arise in consequence of such diseases as typhoid, pneumonia, influenza, erysipelas, and nephritis. The tendency of acute gastritis is toward rapid recovery, provided the cause is removed. Repeated attacks under the influence of continued irritation are likely to result in chronic gastritis.

Prophylaxis.—Care should be exercised in selecting foods that have not undergone putrefactive changes. Hasty eating and chemical and thermal irritants should be avoided.

Treatment.—If the stomach is not empty, it should be evacuated at once, either by lavage or the administration of warm water to promote vomiting. The direct local irritant to the stomach is thus removed and often serious intestinal disturbances may be averted. The use of irritant emetics is contraindicated.

A hypodermic of $\frac{1}{12}$ grain of apomorphin should be given in lieu of lavage or prompt emesis from the use of warm water. Lavage should be performed in all cases in which the stomach has not been emptied by thorough vomiting, especially when it is known that poisonous substances have been swallowed. In such cases an antidote should be administered. The patient should remain in bed and all food and drink should be withheld for from one to five days, depending on the severity of the process. The inflamed mucous membrane, thus protected from the mechanical irritation of food and the chemical irritation of gastric juice, quickly recovers. Thirst should be controlled by supplying liquids by the bowel and the use of cracked ice by mouth. It is of advantage to wash out the mouth frequently. After a few days milk and cream and soft foods, such as gruels of oatmeal, barley, farina, or rice, may be given by mouth and the usual diet gradually resumed. Vomiting sometimes persists after the stomach has been evacuated. Cracked ice may be swallowed. Irrigating the stomach with warm water containing a teaspoonful of sodium bicarbonate to the quart may give relief.

Pain is rarely severe enough to call for active treatment. Hot applications or morphin suppositories may be used. The bowel should be evacuated. The colon should be flushed with warm water and a good dose of calomel should be given by mouth to remove as much of the irritating material as possible. Aside from its well-known disinfecting properties, calomel is perhaps the least irritating cathartic that may be used in such cases. Castor oil may also be used. Drastic purgatives should be avoided. No active medication for the stomach is required. When tolerated, a teaspoonful of bismuth subnitrate suspended in one-half glass of water may be given once or twice daily after the first twenty-four hours.

Acute catarrh of the stomach, developing secondary to other diseases, rarely requires special treatment other than a careful diet, as outlined for the primary affection.

Toxic Gastritis

Toxic gastritis arises from swallowing more or less concentrated carbolic acid, mineral acids, caustic alkalies, metallic salts, corrosive sublimate, arsenic, phosphorus, alcohol, and other caustic agents.

The effect upon the mucous membrane and deeper structures depends on the nature of the poison and its degree of concentration. Arsenic and phosphorus produce inflammation of the glandular elements. The secreting cells undergo fatty degeneration. Mineral acids, corrosive sublimate, metallic salts, and oxalic and carbolic acid produce an eschar by coagulating the albumin of the tissue. Caustic alkalies macerate and, if concentrated, cause deep sloughing.

Perforation rarely takes place. If death is not caused from the immediate effect of the poison, the slough separates. Deep ulcers may develop, and as they heal give rise to deformity of the stomach. Obstruction at the pylorus or cardia may result. In mild cases the destruction of the mucous membrane is only superficial. In any case the most destructive changes are likely to be at the pyloric orifice, lesser curvature, and cardiac orifice.

Treatment.—Vomiting should be induced by giving a large amount of hot water and tickling the throat, if necessary. This should be continued until a stomach-tube is procured. In the meantime an appropriate antidote should be given. Practically always too much or too little of the antidote is given, so that this should be followed at once by introducing a stomach-tube and irrigating the stomach thoroughly with water. Vomiting cannot be depended on to remove all of the toxic substance. The danger of perforating the wall of the stomach by using a tube is more theoretic than real. It is true strong acids or alkalies may cause deep softening of the stomach wall, but only after they have been in contact with it for a considerable period. One should rarely, if ever, hesitate to use the stomach-tube, because of the danger of perforation. Cases in which that danger is present are practically always fatal.

The exact antidote to the various corrosive poisons is rarely remembered. The antidotes likely to be near at hand should, however, be firmly fixed in mind. In general, acids are neutralized by such common substances as chalk, whiting or silver polish, saleratus, washing soda, soapsuds, sweet oil, milk, and eggs. Soapsuds and alkalies are of no value in oxalic acid poisoning, since soluble alkaline oxalates are formed. Plaster from the wall or calcined magnesia may be used.

The most convenient antidotes to the corrosive alkalies are vinegar, lemon juice, olive oil, butter, and lard.

If the patient does not succumb to the direct toxic effect of the substance, the shock, pain, and constitutional symptoms are treated according to general principle. The stomach should be given absolute rest for one or two weeks and rectal feeding should be instituted. A liquid diet should then be given, as in simple acute gastritis. The sequels—ulcer, stricture at the cardia or pylorus—should receive appropriate treatment, described elsewhere.

Phlegmonous Gastritis

Suppurative inflammation of the wall of the stomach is an extremely rare condition. Less than seventy-five cases have been reported. Two forms are recognized: circumscribed phlegmonous gastritis, or abscess of the stomach wall, and diffuse phlegmonous gastritis. The condition may be primary and without apparent cause. Secondary phlegmonous gastritis may arise during the course of pyemia, puerperal fever, and other suppurative processes. Acute cases have been observed in which the local and general manifestations were severe, ending in death in from five to fifteen days. In other cases the course has been more chronic and perforation into surrounding organs has taken place. Death is the usual termination. In a few instances scars have been found post-mortem, thought to have been due to healed phlegmonous gastritis.

The diagnosis can rarely be made with certainty. In suspected cases rest in bed should be instituted and a minimum quantity of liquid food given by mouth, and an ice-bag applied to the epigastrium. Pain and depression should be controlled, as indicated. Lengemann collected sixty cases. All were fatal. Only two were subjected to operation. He adds a case successfully treated by early incision and drainage.

CHRONIC GASTRITIS

Chronic gastritis, or catarrh of the stomach, may be either primary or secondary.

Etiology.—As a primary disease it may arise from the prolonged ingestion of mechanical, chemical, or thermal irritants. Such irritation may be due to the ingestion of coarse foods, poorly cooked foods, overeating, hasty eating, and imperfect mastication because of poor teeth. The continued use of strong condiments and highly seasoned foods, and of hot and cold drinks, may finally result in chronic gastritis. The prolonged abuse of alcohol is one of the most common causes. Repeated attacks of acute gastritis may finally terminate in chronic gastritis.

Secondary chronic gastritis may develop during the course of other chronic diseases of the stomach, such as carcinoma, ulcer, and pyloric obstruction. Chronic gastritis may result from chronic passive congestion, due to portal obstruction, liver cirrhosis, and heart incompetency. The condition accompanies constitutional diseases, such as nephritis, diabetes mellitus, leukemia, pernicious anemia, syphilis, Addison's disease, general carcinosis, and many other chronic affections. Valuable statistics based on accurate clinical data and anatomic findings are as yet wanting to prove the frequency of such a relationship.

Clinical Forms.—1. Gastritis with normal or greater than normal secretion of hydrochloric acid and the ferments (gastritis acida—Boas).

2. Gastritis with secretion of hydrochloric acid, but less than the normal quantity, the ferments normal or moderately reduced (gastritis subacida—Boas).

3. Gastritis with absence of hydrochloric acid secretion. The ferments normal, reduced, or practically absent (gastritis anacida).

Course.—Unless the cause is removed, the anatomic changes present in the mucous membrane are likely to progress. Under appropriate management the secretion may be greatly improved in both acid and subacid gastritis. Even when the secretion of hydrochloric acid is absent, a return of secretion frequently is noted, provided the anatomic process is not so serious as to destroy the secretion of pepsinogen and labzymogen. When there are only traces of the pro-ferments present upon repeated examination, a return of secretion is not to be expected. In any event, emaciation and serious consequences do not arise as long as the small intestine and its digestive secretions are normal and an appropriate diet is given. If the small intestine is not performing its function properly, grave nutritional changes may develop, resulting in death.

Treatment.—One of the most common errors in the diagnosis of gastro-intestinal disorders is to assume that discomfort arising during the period of digestion is due to chronic catarrh of the stomach. Chronic gastritis can rarely be diagnosed without the aid of a test-meal. It must be especially emphasized that as a primary disease, giving rise to symptoms that cause a patient to seek medical aid for relief, chronic gastritis is relatively very rare.

The management of primary chronic gastritis is extremely simple and the results of treatment are highly satisfactory. As prophylactic measures good teeth should be provided. Food should be properly masticated. Irregularities in diet and the abuse of alcohol should be corrected.

The treatment of chronic gastritis with normal or excessive secretion of hydrochloric acid does not differ from the treatment of hyperchlorhydria, described fully elsewhere.

The treatment of the other clinical forms of chronic gastritis, in which the secretion is diminished or absent, may be divided into dietetic, mechanical, and medicinal.

Dietetic.—The regulation of the diet in relation to the manner in which the food is prepared is by far the most important factor. The chief function of the stomach is to subdivide the food chemically and mechanically and to prepare it for the more complete digestion and absorption in the small intestine. If the gastric secretion is reduced or absent, there may be no serious results, provided the small intestine functionates normally and the food is brought to it in a finely subdivided state and free as possible from chemical and bacterial irritants. Under such circumstances, fortunately, the secretions poured into the small intestine are usually more than sufficient to digest all food and prepare it for absorption. A mixed diet should be given. Indeed, the essential indication in the treatment of chronic gastritis is to supply a sufficient quantity of nourishment in the usual proportions of albumin, carbohydrate, and fat, and in such form that it is non-irritating to the stomach or intestine. The mucous membrane of the stomach may be over-sensitive to mechanical, chemical, and thermal irritants. Thus foods mechanically coarse, such as potato salad, fried potatoes, poorly masticated raw apples, raw onions, radishes, and hard-boiled eggs, are to be avoided. Chemical irritants are not always harmful, but, as a rule, the sharp condiments cause distress. Alcohol should be avoided. Ice-water and hot soup and drinks may cause discomfort. Any ordinary form of meat may be eaten, if first reduced mechanically to a state of fine subdivision. Soft eggs produce no irritation. Hard-boiled eggs are well tolerated if they are first grated or even well masticated. If gastric secretion is absent, raw eggs and the connective tissue of meat are not well digested. There need be no restriction in giving carbohydrates, including all vegetables ordinarily eaten, provided they are first mechanically reduced to a soft and non-irritating state. Fats, in the form of cream, butter, and palatable vegetable oils, may be given in any quantity indicated. If desired, a gain in weight each week of from one to three pounds may be readily accomplished by giving daily a pint or more of milk and an equal amount of cream, a liberal quantity of bread and butter, mashed potatoes, eggs, well-cooked rice, together with other non-irritating foods and relishes.

Mechanical Treatment.—Gastric lavage is usually strongly recommended for chronic gastritis. If thick, ropy mucus is secreted in large quantity, it may be of value to remove it by aspiration each morning. That which clings to the surface of the mucous membrane may be dissolved and removed by irrigating with warm water, to each quart of which from one to five teaspoonfuls of sodium bicarbonate or common salt has been added. Otherwise gastric lavage is rarely of value in the treatment of uncomplicated chronic gastritis. As a routine procedure it is to be condemned. Its use has heretofore been based largely upon the false conception that fermentation was always present in chronic gastritis and that it should be overcome by cleansing lavage. If there is no obstruction at the pylorus, the stomach empties itself in normal time, thus preventing the accumulation of harmful germs, without which fermentation does not occur. Gastric lavage is said to stimulate the appetite. That is particularly true when pyloric obstruction exists. In chronic gastritis, uncomplicated by pyloric obstruction, the procedure is rarely indicated.

Medicinal Treatment.—Drugs are rarely necessary to the satisfactory treatment of chronic gastritis with diminished secretion. Astringents, formerly in general use, are not indicated. If necessary, the appetite may be stimulated by bitter tonics, such as tincture of nux vomica and gentian, 5 or 10 drops of each in water, half an hour before meals. Three to 5 grains of orexin may be given in capsule or in bouillon.

Vomiting is rarely present in primary gastritis except when due to alcoholism. It usually ceases when the irritant is withdrawn.

If the gastric secretion is reduced or absent, the administration of hydrochloric acid and the ferments would seem to be indicated. If analysis of the test-breakfast shows the presence of free hydrochloric acid, sufficient secretion is present for gastric digestion. If the total percentage acidity in terms of sodium hydrate is reduced to six or eight, practically no hydrochloric acid is secreted. To supply a sufficient quantity artificially to digest the food is exceedingly difficult. It requires approximately 100 drops of dilute hydrochloric acid to aid in the digestion of 15 grams of albumin. A man weighing 160 pounds requires about 100 grams of albumin each day. Thus about 700 drops of dilute hydrochloric acid are required each day to supply the deficiency when no hydrochloric acid is secreted. The only effectual way of giving that amount is through a stomach-tube, since the unprotected pharynx will tolerate only about 15 drops, three times daily. Theoretically, when secretion is absent, about 250 drops of dilute hydrochloric acid might be administered through a stomach-tube after each meal. If the ferments were absent, pepsin might also be given. This procedure becomes tiresome and, above all, it is unnecessary, provided the small intestine is normal. Hydrochloric acid and pepsin and preparations of pancreatin and all forms of digestive ferments are indicated only when, upon the administration of a carefully prepared and selected diet, containing a sufficient quantity of nourishment, a loss in weight is recorded, and in addition careful microscopic and chemical analyses show a decided increase in undigested albumin, carbohydrates, or fat in the stool. Digestion is usually so complete in the small intestine that such artificial aids are seldom indicated. In 15-drop doses dilute hydrochloric acid sometimes increases the appetite.

The motor power in uncomplicated chronic gastritis is usually normal.

In atrophic gastritis diarrhea is a serious symptom and should always be checked. If the large intestine only is involved, no great harm results, but if increased peristalsis, inflammation, or abnormal fermentative changes extend to the small intestine, much nourishment is lost and the patient loses weight rapidly. Food undigested in the stomach then has a tendency to irritate the small intestine and aggravate the diarrhea.

ULCER OF THE STOMACH

Etiology.—Two essential factors are generally recognized: (1) Malnutrition of a circumscribed area of the gastric wall exposed to the action of the gastric juice. (2) The digestive action of the gastric juice. A local area of the stomach wall that has lost its normal resistance to the action of the gastric juice is digested.

Local malnutrition of the gastric mucosa and underlying tissue may arise from thrombosis or embolism of arterial twigs, hemorrhage, passive congestion, corrosive substances, burns, mechanical injuries from foreign bodies, blows, and pressure. The rôle played by microorganisms in the production of ulcer is probably very slight. Recent observations throw much doubt on the importance, ascribed to it by Riegel and others, of hyperchlorhydria in the production of ulcer. Statistics show that in at least one-half of all cases of gastric ulcer the secretion of hydrochloric acid is normal. In nearly 10 per cent. of all cases it is actually subnormal. Absence of free hydrochloric acid, however, is extremely rare. On the other hand, a high grade of hyperchlorhydria suggests the possibility of ulcer. No other anatomic condition is as commonly associated with excessive hyperchlorhydria. Undoubtedly, hyperchlorhydria is unfavorable to the healing of ulcer. It is also very probable that an area of local malnutrition more readily becomes the seat of ulcer in the presence of hyperchlorhydria.

While in theory the etiology of gastric ulcer seems fairly well established, it is very probable that factors as yet unknown are operative.

Frequency.—Active ulcer or cicatrix is found in from 3 to 5 per cent. of all autopsies.

Location.—An approximate distribution is as follows: Lesser curvature, 33 per cent.; posterior surface, 32 per cent.; pylorus, 14 per cent.; anterior surface, 8 per cent.; cardia, 6 per cent.; greater curvature, 3.5 per cent.; fundus, 3.5 per cent.

Demonstrable scars and open ulcers found at autopsy indicate that the relative frequency of gastric and duodenal ulcer is about nine to one. In operative work the surgeon finds duodenal ulcer approximately as common as gastric ulcer. Duodenal ulcer, however, is prone to lead to obstruction and other complications requiring surgical treatment, while gastric ulcer, unless located at the pylorus, heals more readily and more rarely develops complications requiring the services of the surgeon, hence statistics based upon operative cases are misleading as to relative frequency of location of peptic ulcer.

Complications.—The following complications materially modify the course, symptoms, prognosis, and treatment of gastric ulcer: Pyloric obstruction from cicatrix or spasm of the pylorus, continued secretion, perforation, perigastritis, perigastric adhesions, perigastric abscess, secondary carcinoma. It is very probable that at least 40 per cent. of all cases of gastric carcinoma develop at the seat of ulcer. Herein lies the greatest danger of chronic ulcer.

Course and Prognosis.—If gastric ulcer is recognized early and treated energetically, the tendency is toward rapid healing. Even if unrecognized or poorly treated, recovery frequently takes place. However, the longer an ulcer persists, the deeper and broader it is likely to become. The edges of an old ulcer are likely to be infiltrated with thick layers of connective tissue, constituting a serious obstacle to healing.

The duration of the disease varies from a few weeks to twenty or even thirty years. It is probable that very old, broad, and deep ulcers never heal. Recurrences after healing are not rare.

Mortality.—Many of the statistics on the mortality of gastric ulcer are very unreliable, since they include all cases in which ulcer was present at the time of death, irrespective of the cause of death. In unselected cases Lebert records a mortality of 8 per cent.; Rosenheim, 10 per cent. The death-rate is very greatly influenced by early recognition and systematic treatment. In Fenwick's hospital clinical cases death occurred in 17 per cent., while in his private practice the mortality was 4 per cent. In 556 cases reported by Leube there was a mortality of 2.4 per cent.

Causes of Death.—Death results chiefly from perforation, hemorrhage, and exhaustion incident to pyloric obstruction. The tendency toward the development of secondary carcinoma constitutes the greatest menace to life from gastric ulcer.

Treatment.—Before instituting treatment in a given case of gastric or duodenal ulcer one should make a careful study of the conditions that attend the ulcer for the purpose of determining, first, whether it should be treated surgically; second, what difficulties are likely to be encountered in its medicinal management. The following should be determined as accurately as possible: How long has the ulcer existed? What is its probable location? What complications and sequels, if any, are present? An intelligent and systematic search should be made in every case for evidence of the following complications and sequels of ulcer: (1) Secondary malignant disease. (2) Pyloric obstruction. If present, obstruction from cicatrix should be differentiated from obstruction due to spasm of the pylorus, inflammatory swelling, and local peritonitis. (3) Continued secretion. (4) Perigastritis. (5) Perigastric abscess. (6) Perforation. (7) Perigastric adhesions. (8) Hour-glass or other deformity of the stomach.

A blood examination and chemical analysis of the stools should be made to determine whether hemorrhage is depleting the patient. While it may not be possible to determine with absolute exactness every detail relating to diagnosis mentioned, it should be a matter of routine to investigate every case of ulcer with reference to the conditions and complications enumerated. The time required for such investigation with the degree of accuracy usually attainable at that period should not exceed two or three days, or, at the outside, one week. Often the greater part of what may be learned about the case becomes apparent at the first examination. Only after the points enumerated and other conditions peculiar to the individual case have been carefully and intelligently studied is one prepared to advise whether that particular case should be treated surgically or medicinally, and to otherwise direct the management of the case. It is becoming more and more recognized that surgical treatment is applicable almost entirely to the complications and sequels of peptic ulcer. Surgery is applicable to the uncomplicated disease in rare and carefully selected cases only.

The following absolute and relative indications for surgical treatment should be kept clearly in mind:

1. Secondary carcinoma. If there is good reason for suspecting that a carcinoma is developing at the seat of an ulcer and no contraindication exists, an exploratory operation should be made at once, and, if accessible, the ulcerated area should be removed widely, with due regard to lymphatic distribution.

2. Perforation into the free peritoneal cavity demands immediate operation.

3. Pyloric obstruction of high grade due to cicatrix should be treated surgically. Pyloric obstruction, even of high grade, due to spasm of the pylorus, inflammatory swelling, or peritonitis attending ulcer may yield readily to medicinal management. (See Medical Management of Pyloric Obstruction.)

4. Perigastric abscess should be relieved by surgical operation.

5. If life is threatened by copious hemorrhages or by a more or less constant oozing of blood, operation may be indicated at once in rare and selected cases, to be described later. Moynihan estimates that 97 per cent. of cases of hemorrhage from peptic ulcer are best treated medicinally.

6. If perigastric adhesions interfere seriously with the motility of the stomach, or produce sufficient pain, surgical intervention may be indicated.

7. Hour-glass stomach usually requires surgical relief.

8. A copious continued secretion complicating pyloric obstruction of mild grade that resists careful management such as is subsequently described may justify gastro-enterostomy in selected cases.

If gastric or duodenal ulcer is complicated by any of the conditions as described, operative treatment is indicated without question, provided no contraindication exists. In the vast majority of all other cases medicinal treatment is indicated, because when such complications and sequels of ulcer as may be removed or relieved mechanically are not present, surgery can do nothing of consequence, except when the ulcer is so located that it may be excised. In rare and selected cases an attempt to excise at once may be justified if the history renders it certain that the ulcer has been active for a period of years. The possibility of a fresh recurring ulcer must be considered when a history of interrupted gastric discomfort of long duration is elicited. Unfortunately, the location, presence of adhesions, and absence of visible signs enabling the operator to locate the ulcer too often prevent excision.

The former practice of performing gastro-enterostomy in practically all cases, whether associated with pyloric obstruction or not, has fallen into disrepute since laboratory experiment combined with actual test of the motor power after gastro-enterostomy has demonstrated that gravity has little to do with the passage of food and secretion from the stomach. After gastro-enterostomy, with or without pylorectomy, the stomach empties itself in approximately normal time. The immediate drainage effect that was supposed to take place after gastro-enterostomy unfortunately does not occur. It has also been determined that after gastro-enterostomy the stomach continues to empty itself largely through the pylorus as long as the natural passage is reasonably free. Hence, the relief from chemical and mechanical irritation after gastro-enterostomy is not so certain as was formerly supposed, and is obtained only when actual obstruction exists. In those cases in which clear indications for surgical treatment as outlined do not exist, medicinal management should be instituted, and the results are likely to prove satisfactory largely in proportion to the skill employed.

Failure in the medicinal treatment of uncomplicated gastric or duodenal ulcer is usually attributable to faulty management. In many cases the treatment is simple. In some cases, however, the greatest vigilance and skill are required. The details of diet, frequency of feeding, the administration of alkalies, the careful control of the gastric secretion during the night, and other factors peculiar to the individual case, may call for great experience and skill of the highest order. Only those who have successfully treated many apparently intractable cases of ulcer know of the various ways in which seeming difficulties may usually be overcome. The results that may be obtained demonstrate that there is no lack of incentive on the part of the medical man to attempt to develop a technic in his management of ulcer as accurate and painstaking as that required by the surgeon in his operative work.

Uncomplicated gastric or duodenal ulcer of a few weeks' or months' duration is one of the most satisfactory diseases of a serious nature the physician is called upon to treat. Under proper medicinal management the tendency is toward rapid healing. An ulcer of six or eight months' or one and a half years' duration heals more slowly, requiring perhaps a corresponding time to heal. The symptoms, however, may disappear at once and never return, provided proper medicinal management is instituted and maintained. If an ulcer has persisted uninterruptedly for years until the edges have become indurated and anemic from the continued deposit of connective tissue, healing takes place very slowly. It is to be understood that an ulcer may become so old, broad, deep, and indurated that healing may never take place. In such cases the patient may be kept practically free from discomfort by the use of proper diet and alkalies. A real cure may be accomplished only when excision or resection is possible.

It is not always easy to determine how long an ulcer has existed. Careful analysis of a history of gastric discomfort of long duration may reveal the probability of a recent recurrent ulcer which may heal promptly under medicinal treatment. In every case under management the patient must be impressed with the seriousness of allowing an ulcer to continue and the necessity of coöperating with the physician for a period of several months or a year or more. For years reasonable care in diet must be observed. If warned that the longer an ulcer persists the slower it heals, the greater the likelihood of the development of cancer and other serious complications, the most refractory patient will usually appreciate the necessity of carefully following instructions.

Owing to the abundant vascular supply, gastric and duodenal ulcer would heal as rapidly as ulcer elsewhere were it not for the digestive action of the gastric juice. The indication in medicinal treatment should be to reduce the corrosive action of the gastric juice, to diminish the mechanical irritation caused by food, pressure, peristalsis, and active movements of the body, to provide adequate nourishment and to treat the symptoms and complicating conditions as they arise.

In uncomplicated cases, with individual exceptions, the writer has found the following management most serviceable: The patient should be given absolute rest in bed for at least three or four weeks, and may then sit in an easy chair near the bed for half an hour in the forenoon and afternoon. If there is no discomfort, the length of time may be gradually increased until at the end of another week the patient may be up the greater part of the time and allowed to walk about the room or yard moderately. No actual work should be done for a period of seven or eight weeks at least. If such complications as perigastritis, inflammatory swelling, local peritonitis, or hemorrhage exist, a much longer period of rest may be required. One can rarely find justification for attempting to treat a case of peptic ulcer without a preliminary period of rest in bed.

During the first five days no food or drink is given by mouth. Approximately 12 ounces or a pint of normal salt solution should be given per rectum about four times daily; more may be given if retained. Troublesome thirst may be controlled by washing the mouth frequently with water or by giving bits of cracked ice. No water should be swallowed.

At the end of five or six days one may begin to feed half an ounce each of milk and cream every hour from early morning until eight or nine o'clock at night. Each morning, half an hour before feeding is begun, a teaspoonful of bismuth subnitrate should be given in half a glass of water. Midway between each feeding a powder consisting of 10 grains each of calcined magnesia and sodium bicarbonate may be given alternately with a powder of 10 grains each of bismuth subnitrate and sodium bicarbonate. The powder should be given in an ounce of water. If the patient cannot afford a constant attendant, a well-stoppered bottle, such as an ordinary pop bottle, may be filled with equal parts of milk and cream and kept in a pitcher of water at the bedside, together with the powders, drinking-water, and a measuring glass.

If there is no discomfort during the first day, on the second an ounce each of milk and cream may be given every hour and the powders continued the same as on the first day. On the third day the milk and cream may be increased to 1½ ounces each, every hour. After two or three days more, a soft egg may be added to the milk and cream in the forenoon, and again in the afternoon, if desired. If there is no discomfort, the following day 3 ounces (measured after it is prepared) of a well-cooked cereal may be added at noontime, if desired. After two days more, another 3 ounces of cereal or a soft egg may be added. After a day or two, another egg or cereal portion may be added. Thus gradually increasing the diet, the patient will usually be able to take the following foods comfortably toward the end of the second week, after feeding is resumed: One and a half ounces each of milk and cream every hour from seven in the morning until eight at night, and, in addition, two or three eggs and two or three feedings of 3 ounces of a well-cooked cereal. The total bulk at any one feeding should not exceed 6 ounces, when feeding every hour. The number of eggs and quantity of cereal given should depend on the individual requirements. The maximum should not exceed four eggs and four feedings of cereal in addition to the milk and cream. The egg may be given in any form except hard-boiled or fried. The cereals may consist of well-cooked rice, oatmeal, farina, or cream of wheat.

Under the influence of such a diet a sufficient quantity of nourishment is taken to cause a gain in weight of from 1 to 4 pounds each week.

The powders are to be taken alternately midway between each feeding, as on the first and second days. If an uncomfortable diarrhea results, the soda and bismuth powder should be substituted for the soda and magnesia powder a sufficient number of times to control it. If constipation develops, the magnesia and soda powder should be given more frequently than alternately. In general, because of the greater neutralizing power, the magnesia and soda powder should be given as many times during the day as possible without causing an uncomfortable diarrhea.

At the end of about three weeks after the feeding is resumed, if desired, a small quantity of stewed fruits, jellies, and seedless marmalades may be added. Cream soups of all kinds may be substituted for any one or two feedings during the day. Toasted cracker and milk-toast may be taken during the third week. Purée of potato may be taken during the third and fourth weeks. During the fourth week the length of time between each feeding may be increased gradually, so that at the beginning of the fifth week food is taken every two hours. The total bulk consumed during the twenty-four hours should not be increased and no more than 8 ounces should be given at any one time, while feeding every two hours. Usually the milk and cream is increased to about 2½ ounces each at this period. Various vegetable purées and ordinary bread may be taken if desired.

The powders should be continued as before, that is, midway between the feedings, and the quantity taken each time may be proportionately increased. The order in which the various foods mentioned may be added to the milk and cream from hour to hour during the day admits of wide latitude and may be regulated to suit the taste and convenience. After two or three weeks more, feeding every three hours may be established. If the ulcer is of several months' duration, it is best not to increase the length of time between the feedings too rapidly. Ordinarily it would be well to eat not less than five times daily for a period of several months, depending on the duration of the symptoms previous to treatment.

The morning bismuth in teaspoonful doses should be taken six or eight weeks and then discontinued. The other powders should be continued midway between each feeding for three or four months, if the ulcer is recent, and for several months more, with a week or ten days' interval, every four or five weeks, if the ulcer is of long standing.

The mixture of milk with cream, soft eggs, cereals, and other semi-solid foods prevents the development of bulky curds. The wide variety of foods permitted renders the diet palatable. The small quantity taken at one time reduces the mechanical irritation and peristaltic action of the stomach and duodenum to the minimum. The frequent feedings, together with the frequent administration of alkalies, reduces the corrosive action of the gastric juice to such an extent that usually no more than a trace of free hydrochloric acid is present at any time from early morning till late at night.

The pain and discomfort of uncomplicated gastric and duodenal ulcer are due to the irritation of the raw surface of the ulcer with hydrochloric acid. The corrosive action of the gastric juice retards healing. Hence, pain is controlled and the healing process is greatly favored by reducing the acidity to the minimum.

During a period of a year or more, milk, cream, cereals, soft eggs, vegetable purées, cream soups, bread and butter, and meats when desired, should form the basis of the diet. In general, it should not be assumed that the ulcer is surely healed until the patient has resumed a normal diet and thereafter has remained free from symptoms of ulcer for a period of at least six months. It should be remembered that an uncomplicated ulcer that is healing properly is not painful. Usually after the first few days of treatment the subjective symptoms entirely disappear and do not return, although the ulcer may not be entirely healed for weeks or months, or even a year or more, depending on the size, depth, and previous duration of the disease. Should discomfort continue or return under careful medicinal management, it is usually indicative of some complication, such as continued secretion, perigastritis, or the presence of a malignant growth.

Meat broths and lean meats of various kinds, finely subdivided and in small quantity, are well tolerated at any time during the treatment of ulcer. Since meat preparations may give chemical reaction for blood in the stool, it is advisable not to use them during the first two or three weeks of the management, or until daily chemical analysis of the stools shows that the oozing of blood has entirely ceased. An ulcer that is healing properly usually stops bleeding after the first two or three weeks. If the reaction for blood continues an unusually long time, that, together with other signs, may suggest the presence of carcinoma.

Individual peculiarities may require various modifications of diet. For example, a patient who dislikes milk and cream may readily take it if given with grape juice, tea, or cocoa, or other flavors. The white of an egg may be substituted for milk. Frozen balls of butter may be substituted for cream. A small quantity of cereal may be given each hour with cream and milk. Various milk and cream preparations may be substituted now and then if the diet becomes monotonous. Cream soups may be given from the beginning, if desired. Non-irritating jellies and gelatin preparations may be given early. While it is possible to obtain good results in the management of certain cases of ulcer by giving food from the very beginning of the management, less frequently, in larger quantities, and without the use of alkalies, in the majority of cases better results are obtained by feeding small quantities and every one or two hours, combined with alkalies in sufficient quantity to reduce the corrosive action of the gastric juice to the minimum.

Pain and discomfort arising during the medicinal management of ulcer should be carefully analyzed. In uncomplicated ulcer the original pain and discomfort usually disappear during the first few days of treatment. If pain or discomfort returns under medicinal management, its cause should be sought at once. If discomfort appears just after taking cold drinks, or if it occurs at irregular periods and is associated with diarrhea, the colon is probably at fault. An enema of hot water will usually aid in locating colon discomfort. Continuous pain or discomfort, aggravated by breathing, associated with local tenderness, elevation of temperature, and an increase in leukocytes, is suggestive of perigastritis or threatened perforation.

The pain and discomfort of uncomplicated ulcer are due to the irritative action of hydrochloric acid on the nerves exposed in the ulcer. If at the height of the discomfort aspiration of the stomach contents reveals an inadequate acidity, or if the discomfort is not temporarily relieved by food-taking or the administration of a teaspoonful of calcined magnesia, it is very improbable that the return of discomfort is due to uncomplicated ulcer.

Continued secretion is one of the common causes of a return of discomfort, and no doubt is responsible for many failures in the medicinal management of ulcer, as ordinarily applied. Physiologically, as soon as all food has passed on into the duodenum, the secretion of gastric juice stops. When continued secretion exists, the gastric glands continue to pour out the same corrosive gastric juice after the food has entirely left the stomach. During the night, when neither food nor alkali is present to neutralize the gastric juice thus abnormally secreted, the granulation tissue is eroded and healing of the ulcer is greatly retarded.

Continued secretion rarely occurs except in connection with pyloric obstruction. It should be suspected in every patient afflicted with ulcer who complains of being annoyed by discomfort at one or two o'clock at night or toward morning. Aspiration of the stomach six or ten hours after the last feeding may reveal the presence of several hundred cubic centimeters of clear, corrosive gastric juice.

A continuation or return of discomfort under proper medicinal management, unexplained by adequate acidity, continued secretion, perigastritis, gall-bladder disease, or uncomfortable peristalsis of the bowel, may be indicative of malignant disease, and justify exploratory operation.

Treatment of Special Conditions.—*Pyloric Obstruction and Continued Secretion.*—The indications for surgical management of pyloric obstruction due to cicatrix arising from ulcer have already been stated and are elaborated more fully under the heading of pyloric obstruction. Ulcer located at or near the pylorus, accompanied by pyloric obstruction due to spasm of the pylorus, inflammatory swelling, or local peritonitis, may require careful modification of the treatment outlined for simple uncomplicated ulcer.

At the beginning of the treatment, if no contraindication exists, all stagnating food and secretion should be removed by the stomach-tube. A continued secretion is so likely to complicate cases of pyloric obstruction that the tube should be used at the end of the first day of the starvation period to determine whether gastric juice is accumulating. If none is present at that time, it is not likely to appear later. In many cases, however, from one to several hundred cubic centimeters of strong, corrosive gastric juice is found. The larger the amount, the greater the tendency for it to persist subsequently. After two or three aspirations, ten or twelve hours apart, the secretion usually ceases. If it persists after three or four days, so that three or four hundred cubic centimeters of strong gastric juice accumulates between each aspiration, it may be inadvisable to further prolong the starvation period. The ulcer and glandular irritability may often be better soothed by beginning to feed every hour in the regular manner, giving the alkalies midway between each feeding; and if no contraindication exists, aspirating the remaining food and secretion two hours after the last feeding every night for a week or more. As a rule, however, the secretion does not persist after the first forty-eight hours of treatment. The starvation period should then be continued a week or more, if the general condition of the patient remains good. The longer the irritated and locally inflamed ulcerated area is protected, the better. Following the starvation period the usual management of simple ulcer may be adopted. If no contraindication exists, it is well to aspirate the stomach now and then in the morning to determine whether food or secretion is retained overnight. If none is found, the quantity of food may be gradually increased approximately in the manner advised in the feeding of the uncomplicated case. An ounce of olive oil may be given three times daily when tolerated. If, as the quantity of food is increased retention does not recur, the ulcer is likely to heal about as rapidly as ulcer located elsewhere, and recovery occurs, provided, in the healing, cicatricial narrowing does not finally cause retention of food. If retention of food overnight recurs as the quantity of food is gradually increased, pain and local tenderness being absent, the obstruction should be treated surgically if no contraindication exists.

Hemorrhage.—Should symptoms of hemorrhage appear, with or without hematemesis or visible blood in the stool, the patient should be placed in bed and every unnecessary movement avoided. A hypodermic of $\frac{1}{6}$ or $\frac{1}{4}$ of a grain of morphin should be given, followed by $\frac{1}{3}$ or $\frac{1}{2}$ grain, contained in a suppository. The foot of the bed should be elevated and a light ice-bag placed over the stomach. Thus managed, hemorrhage usually stops, unless a large blood-vessel has been eroded. If dangerous hemorrhage continues, the stomach-tube may be passed and ice-water poured in and withdrawn as many times as is apparently justified. No more than a pint should be introduced before it is withdrawn. Very hot water alone or containing a 2 per cent. solution of perchlorid of iron may be used in the same way. In extreme cases blood may be collected and retained in the lower extremities by placing tight bandages about the upper part of the thighs. In other cases the great loss of blood may require transfusion of a quart of salt solution. Thirty drops of a 1 : 1000 adrenalin solution may be given every hour for two or three doses. Hypodermatic injection of ergotin is of questionable benefit; likewise the use of local styptics, such as 15 drops of perchlorid of iron in one-third of a glass of water every hour, or 1 grain of acetate of lead every hour. No food or drink should be given by mouth for four or five days, and salines should be given per rectum during the first twenty-four hours, for fear of exciting peristalsis of the stomach and duodenum. The Lenhartz method of feeding eggs and cold milk the same day the hemorrhage occurs has not been generally adopted.

Surgical operation for the control of hemorrhage may be adopted in selected cases, provided copious hemorrhage threatening life is repeated within a few hours, or two or three days. It should be adopted if under appropriate medicinal management blood continues to ooze in sufficient quantity to give rise to a gradually increasing and serious anemia. In such cases operation should not be delayed until the hemoglobin is reduced below 40 per cent. Should the case come under observation after copious hemorrhage has reduced the patient so that the pulse is rapid and very weak, the blood-pressure very greatly lowered, and the pallor extreme, it is doubtful whether operation should be performed. Such cases not infrequently recover, while the shock attending operation under such circumstances is likely to prove fatal. Of the total number of cases that die from hemorrhage, about 15 per cent. die during the first hemorrhage, and usually before surgical treatment can be instituted. In about 35 per cent. death occurs within twenty-four or thirty-six hours, from repeated hemorrhages. Surgery should save some of these cases. In the remaining 50 per cent. death results from hemorrhages repeated at longer intervals or from a more or less constant oozing of blood, usually passed with the stool. Surgery should save some of these cases.

Surgery may accomplish excision of the ulcer, ligation of blood-vessels, cauterization of the bleeding surface, and gastro-enterostomy. Formerly gastro-enterostomy was the usual operation performed. It was then supposed that immediate drainage of the stomach followed the operation, thus relieving the ulcer of the corrosive action of the gastric juice. Except when pyloric obstruction exists, gastro-enterostomy is not justified. When possible, excision is the ideal operation. In a given case of serious hemorrhage the exercise of careful judgment is required before concluding that surgical treatment is advisable. It is well to remember that surgical interference is justified in only about 3 per cent. of all cases.

Perigastric and threatened perforation should be treated by absolute rest and by total abstinence from food and drink. After twenty-four hours the use of rectal salines is indicated until the acute symptoms have subsided. Symptoms of perforation into the free peritoneal cavity demand immediate laparotomy.

Anemia may require the use of Blaud's mass. Constipation seldom requires special treatment when calcined magnesia is taken as advised.

Secondary Carcinoma.—Carcinoma developing at the seat of an ulcer should be treated surgically, as already described. The writer wishes strongly to emphasize the following points relating to gastric ulcer. Statistics show that approximately 37 per cent. of all carcinomata are located in the stomach. Conservative estimates indicate that probably 40 or 50 per cent. of these cases develop at the seat of an unhealed ulcer. Uncomplicated peptic ulcer of a few weeks' or months' standing heals readily under careful medicinal management. In some cases the symptoms of ulcer are latent; however, the majority of all patients afflicted with ulcer present themselves to a physician complaining of stomach symptoms reasonably early in the course of the disease. Relatively few cases are diagnosed until the disease is more or less advanced.

It is clearly the duty of every physician to become thoroughly familiar with the early signs and symptoms of ulcer, so that he may be able to recognize the condition, treat it energetically, and thus largely prevent the complications requiring surgical treatment and lessen the tremendous waste of life incident to the development of carcinoma at the seat of a neglected ulcer.

CARCINOMA OF THE STOMACH

According to Virchow, 37 per cent. of all carcinomata affecting the human body occur in the stomach. About 60 per cent. of all cases occur between the ages of forty and sixty. Approximately 15 per cent. occur between the ages of thirty and forty, and an equal percentage between the ages of sixty and seventy. At the time of death the majority of the growths are located at or near the pylorus. It is probable that approximately 40 per cent. have their origin on the lesser curvature, and nearer the pyloric than the cardiac orifice. As these tumors grow, they usually extend toward the pylorus, and may finally cause obstruction. The cardiac orifice is the next location in frequency. Other locations are relatively rare.

Metastatic growths are common, and unfortunately occur relatively early. In order of frequency they occur in the lymph-glands, liver, peritoneum, omentum, intestine, pancreas, skin, pleura, lung, spleen, and brain. Clinically, it is important to know that secondary growths in the glands about the rectum are perhaps more frequently palpable than elsewhere.

Course and Duration.—The disease is gradually progressive. The duration is influenced by the seat and character of the growth. If the orifices are involved, death is hastened by mechanical obstruction. After symptoms of the disease are present, the average duration of life is about one year. Death usually results from marasmus. If high-grade pyloric obstruction exists, sufficient nourishment is not absorbed by the stomach and starvation quickly results. Death may be hastened by constant oozing of blood, by perforative peritonitis, septic inflammation of the pleura or lung, and other complications.

Treatment.—*Prophylaxis.*—It is conservatively estimated that from 35 to 50 per cent. of all cancers of the stomach develop at the seat of gastric ulcer. Much higher estimates have been given. Gastric ulcer recognized reasonably early and treated skilfully heals in a relatively short time. Cancer develops from neglected and unhealed ulcer. By far the most efficient treatment of gastric cancer is early recognition and intelligent management of gastric ulcer.

Surgical Treatment.—Unfortunately, except when preceded by gastric ulcer, the disease, as a rule, develops so insidiously that by the time symptoms arise the adjacent lymph-glands are already invaded and complete eradication of the disease by operation is impossible. Nevertheless, surgical measures have a wide application in treatment of carcinoma of the stomach, and as soon as the diagnosis is made, one is compelled to decide whether operative treatment is advisable or medicinal treatment alone is indicated. In a given case the solution of the problem is usually not difficult if one keeps in mind the contraindications to operative procedure, and understands clearly what may be accomplished by surgical intervention. Advanced cachexia, as shown by edema and anemia gradually developing until the hemoglobin is reduced to 40 per cent., is usually a contraindication to extensive operation. In such cases the heart muscle often shows a high degree of degeneration and death is likely to follow soon after the operation.

If the loss in hemoglobin has resulted from recent hemorrhage, operation may be undertaken with 35 per cent. and even less. A relatively too high hemoglobin estimate, due to concentration, is likely to be present if there is obstruction at the pylorus. High-grade arteriosclerosis, diabetes, Bright's disease, and other serious constitutional diseases present the usual contraindications to operation. When no contraindication exists, the following surgical measures may be employed in selected cases: (1) Resection of the tumor and a portion of the adjacent stomach; (2) gastro-enterostomy; (3) jejunostomy; (4) gastrostomy.

1. *Resection of the Tumor.*—Early diagnosis and resection of the tumor is the ideal treatment. Unfortunately, until more accurate means are devised for the early recognition of carcinoma of the stomach, the number of cases in which the disease may be completely eradicated will remain distressingly small. In selected cases, however, a resection of the tumor is justified, that life may be prolonged and comfort increased, even when a return of the disease is to be expected. Although improved technic and skill have greatly reduced the danger of the operation, the average mortality is still about 20 per cent. The most skilled operators have reduced the mortality to 10 per cent. and less by carefully selecting the cases. In determining whether resection is advisable, the following factors are to be considered: the duration of the disease; the location, size, and mobility of the tumor; and the presence of metastases. Extensive adhesions and fixation of the tumor from penetration of the growth into the surrounding tissue form the most serious obstacle to successful resection. In general, tumors that are located at or near the pylorus and are freely movable and small, and not associated with evidences of metastases and advanced cachexia, are the most favorable for resection. Great caution must be exercised if unfavorable conditions exist. In many cases the exact condition as to location, extent, fixation, and metastases is disclosed only after the abdomen is opened. If it is then determined that resection is inadvisable, a gastro-enterostomy may be performed, if obstruction at the pylorus exists or is threatened. The ability of the stomach to empty itself should be determined before operation by giving motor meals. Since the onset of symptoms of gastric carcinoma is usually vague, and as yet no reliable early diagnostic sign of the disease exists, exploratory incision at the risk of a mistake in diagnosis is justified in such cases as present, after intelligent study, suspicious symptoms of incipient carcinoma. It is only by adopting such measures that resection of the tumor offers hope of completely arresting the disease.

Owing to late diagnosis, or disinclination on the part of the physician to advise or the patient to permit an early operation, resection of gastric cancer is performed much less frequently than it should be. The greatest advances in the treatment of carcinoma of the stomach are to be made by improving methods of early diagnosis, adopting exploratory incision in selected cases, and urging early resection of the tumor when possible.

2. *Gastro-enterostomy.*—In practice, gastro-enterostomy is the operation most frequently performed in the treatment of cancer of the stomach. The object is to provide a passageway from the stomach into the intestine when there is an obstruction at the pylorus. It is rarely, if ever, indicated for carcinoma that does not involve the pylorus or pars pylorica in such a way as to cause retention of food. Whenever possible to do so with a reasonable degree of safety, resection of the primary tumor mass should accompany gastro-enterostomy. If not, the sloughing mass remains as a serious source of disordered metabolism and secondary deposits. If pyloric obstruction does not appear until relatively late in the course of the disease and resection is inadvisable, the attempt should first be made to determine whether the nutrition of the patient may not be satisfactorily increased by rest in bed, and by soft, mushy, or liquid diet, often combined advantageously with gastric lavage. No food by mouth, combined with rectal feeding, as in gastric ulcer, for two or three days is often attended by excellent results in cases of carcinoma at the pylorus associated with inflammatory swelling, suggested by the presence of local pain and tenderness on pressure. Often upon resuming a liquid diet with a continuation of rest in bed the symptoms of obstruction do not return for many weeks. If, notwithstanding these measures, food is still retained overnight, vomiting persists, and the quantity of urine is reduced to a pint or less each twenty-four hours, the obstruction is great and the patient will soon die unless relieved by gastro-enterostomy or jejunostomy.

The results of gastro-enterostomy are very satisfactory in selected cases. The mortality is less than from resection. The temporary relief afforded in many cases is extremely satisfactory. Vomiting ceases and the patient may gain 20 or 30 pounds in weight, and be relatively free from discomfort for many weeks or months. The majority of cases die within the first eight months after operation. Cases that have lived two and even five years have been reported. Now and then, although the patient survives the immediate effects of the operation, vomiting continues and death is hastened.

3. *Jejunostomy* was devised by Maydl as a substitute for gastro-enterostomy because of the rapidity with which it could be performed and the relatively small amount of shock attending the operation. The escape of irritating intestinal juices and the mental depression usually experienced by the patient are drawbacks to the operation.

4. *Gastrostomy* may be justified for the purpose of feeding the patient in case the cardiac orifice is occluded by cancer.

Of the surgical methods mentioned, early diagnosis and resection approaches the ideal. Surgeons should strive for greater perfection in the technic of resection. Medical men should advise exploratory operation, with a view to a possible resection as soon as the diagnosis is made, unless contraindications to operation exist. Early resection should more frequently take the place of late gastro-enterostomy.

Medicinal Treatment.—By far the greater number of cases of carcinoma of the stomach are not subjected to surgical operation. This is due to late diagnosis and the tendency of the patient or physician to defer a more or less serious operation as long as a fair degree of comfort is obtained. Finally, owing to the location or fixation of the tumor, or the presence of extensive metastases, resection is impracticable. Surgical treatment is then contraindicated unless there is obstruction at the pylorus or the cardiac orifice.

If obstruction at the pylorus appears early, so that it is evident that death from inanition will terminate life much earlier than would occur from carcinoma without mechanical obstruction, gastro-enterostomy should not be delayed; as the disease advances, the dangers of the operation are increased. If, on the other hand, obstruction appears relatively late, even though the case may appear able to survive a gastro-enterostomy, it is advisable to determine what may first be done by medicinal treatment. Under the influence of rest, appropriate diet, and lavage, the outlook is not so unpromising as to cause one necessarily to choose operative measures, particularly in cases where the risk appears very great.

When surgical treatment is contraindicated or denied, the mistake is too often made of abandoning patients to their friends with the simple instruction to make them as comfortable as possible. Much may be done to keep up the body-weight and to contribute to their comfort. The means at our disposal are diet, lavage, and drugs. The appetite may be stimulated by gastric lavage once daily, if there is obstruction at the pylorus. If no obstruction exists, the appetite may be increased by the use of bitter tonics, such as the tincture of nux vomica and gentian in 5- or 10-drop doses, given with the syrup of orange peel. A capsule of 5 grains of orexin may be given before each meal. Vomiting due to the retention of food from pyloric obstruction is usually relieved by removing the stagnating food, followed by gastric lavage once daily. In other cases relief may be obtained by giving 4 or 5 drops of chloroform in cracked ice, champagne on ice, or 2 or 3 drops of creasote in water. Heat or cold applied to the epigastric region is sometimes efficacious. Morphin hypodermatically, or administered in suppositories, may be used.

Pain due to pyloric obstruction, often cramp-like in character, is best relieved by the use of the stomach-tube. Liquid foods only should be given if there is retention of food. Rest in bed is of great value in controlling the pain of gastric carcinoma.

Finally, when necessary, opiates by mouth, rectal suppositories, or subcutaneous injection should be given in sufficient quantity to afford relief. Constipation is best treated by enemas. There may be no objection to simple laxatives. Concentrated salts often increase pain, and should, therefore, not be used. Diarrhea may be controlled by rest in bed, hot applications to the abdomen, and the use three times daily of a teaspoonful of a powder containing equal parts each of phosphate and carbonate of calcium and subnitrate of bismuth.

Diet.—The chief indication is to give a sufficient quantity of non-irritating food in such form that it may readily pass through the pylorus. If there is no obstruction at the pylorus, a mixed diet, containing the usual proportions of albumin, fat, and carbohydrate, may be given in a state of fine subdivision, described in detail in the treatment of chronic gastritis. It must be remembered that the appetite may be no index to the amount of food required. Much of the emaciation of gastric carcinoma is due to a reduction of the quantity of nourishment taken because of diminished appetite. If there is no obstruction at the pylorus, the emaciation need not be greater than that from carcinoma elsewhere, provided a sufficient quantity of nourishment is taken. When pyloric obstruction is present, a liquid, or at least a soft or mushy, diet should be given exclusively. A pint each of milk and cream, scraped beef, eggnogs, nourishing vegetable soups, and vegetable purées should be given the preference. Any food that is finely subdivided and well masticated may be given when it is chemically non-irritating. Since fluids are not absorbed by the stomach, the quantity of urine passed each day is the most valuable index to the amount of nourishing fluid that passes the pylorus. When the quantity of urine sinks to 400 or 500 c.c. each day, the obstruction is very great, and death from inanition is not far distant.

Although the stomach may be overdistended with fluids, *thirst* may be intense, if the carcinoma causes pyloric obstruction. A pint or a quart of normal salt solution should be given per rectum two or three times daily to supply the deficiency in liquids. The stomach absorbs alcohol, peptones, sugar, and dextrin. Nutriment in these forms may be supplied in abundance, but life cannot long be sustained by such methods, when pyloric obstruction is of high grade.

Gastric hemorrhage from cancer should be treated by rest in bed, cold applications to the epigastrium, and the use of practically the same means as advised in the control of hemorrhage from gastric ulcer.

Gastric lavage is indicated only when the cancer is obstructing the pylorus sufficiently to cause retention of food from day to day. If the stomach is empty each morning, lavage is usually of no value. When stagnation exists, if the patient tolerates the tube well and hemorrhage is not produced, the stomach contents may be aspirated in the morning before breakfast, and just before the evening meal. Ordinarily, it is inadvisable to use lavage more than once daily, preferably in the morning, or late at night. In many advanced cases better results are obtained by using lavage only once every second day. If great weakness exists, it is sufficient simply to aspirate without lavage.

If a foul odor, indicative of a sloughing surface, is present, creolin or lysol, 10 or 15 drops to a quart of water, a 2 per cent. solution of resorcin, or 40 grains of salicylic acid to a quart of water may be used interchangeably.

When stagnation exists, gastric lavage, if well tolerated, increases the appetite, relieves the sensation of fullness and pressure, and allays vomiting. Thiosinamin, methylene-blue, trypsin, and radium have all proved of no particular value in the treatment of carcinoma of the stomach.

ACUTE DILATATION OF THE STOMACH

Acute dilatation of the stomach is characterized by a rapidly developing enlargement of the cavity of the stomach, together with the stagnation of food and secretion. In a large number of cases a portion or all of the duodenum shares in the dilatation. A copious transudate poured into the cavity of the stomach contributes to the stretching and overdistention of the gastric walls. The lower border of the stomach may reach the pubic arch. Discomfort or severe pain is felt in the epigastric region and vomiting usually occurs. In severe cases the vomiting is usually copious, dark green, and may have a fecal odor. The pulse becomes rapid and small; prostration and collapse supervene, and unless active treatment is instituted, death is likely to occur. A fatal termination may take place within the first two days, or may be delayed a week or ten days.

Sixty-four cases, collected by Neck, showed a mortality of over 73 per cent. Mild grades of acute dilatation are probably not rare. The severe grades are common enough to warrant a close study of the condition. Early recognition and active treatment should reduce the mortality very greatly.

Etiology.—The exact mechanism of acute dilatation is obscure. A study of the clinical cases together with autopsies renders it probable that the condition may arise from different and in part as yet unknown causes. Acute dilatation of the stomach, together with stagnation of the food and secretion, may result apparently from a sudden paresis of the gastric muscle incident to physical injury, surgical shock, or operation, involving particularly the abdominal viscera. Of the sixty-four cases collected by Neck, twenty-eight followed surgical operation, and of these seventeen were laparotomies, the greater number being for the relief of gall-stone disease. In many cases the condition resembles closely a paralytic ileus. Acute paresis of the gastric muscle may also occur in pneumonia and other severe infectious diseases, such as typhoid. In many cases evidence of duodenal obstruction due to mesenteric constriction and other causes has been found. Acute dilatation involving both the stomach and a part or the whole of the duodenum is the most severe type of the disorder.

Treatment.—Early recognition of the condition is extremely important. Vomiting and epigastric distress continuing twenty-four hours after an anesthetic should be regarded with suspicion. In a suspected case the stomach-tube should be introduced and the gastric contents removed by aspiration, followed by gentle lavage, if the patient is not exhausted. The most important consideration, however, is the removal of the retained secretion. This should be repeated every two or three hours, or as often as is justified by the amount recovered. After the first three or four aspirations, once every four or six hours is usually sufficient. It is frequently necessary to use the tube for several days. No food or drink should be given by mouth. Salt solution should be given by bowel, and continued for several days, or until the symptoms have disappeared. If not retained by the bowel, the solution should be given beneath the skin in the loose cellular tissue. Atropin, gr. $\frac{1}{100}$, and strychnin, gr. $\frac{1}{60}$, should be given hypodermatically. If there is a tendency to paresis of the whole bowel, eserin, gr. $\frac{1}{100}$ or $\frac{1}{50}$, hypodermatically every two or three hours, may be beneficial. Strychnin should be given at the same time. A salt and glycerin enema may stimulate intestinal peristalsis.

Posture is a valuable therapeutic measure. In the majority of cases it is best to elevate the foot of the bed and place the patient on his left side, or on his abdomen, to overcome the pressure of the stomach against the duodenum, to lessen the tendency to a kinking of the duodenum, and possibly remove the drag of the mesenteric vessels on the duodenum. Operations for the relief of the condition have generally proved unsuccessful. Gastro-enterostomy gave relief in one case. In another case a kink in the duodenum was relieved.

Early recognition, posture, and frequent use of the stomach-tube to relieve the overdistention, the administration of salines by bowel, and stimulants as indicated, are the essential factors in the medicinal treatment of the condition.

CHRONIC DILATATION OF THE STOMACH

(*Synonyms*: Chronic gastric stagnation of high grade; ectasia ventriculi, motor insufficiency of second degree—Boas.)

The term dilatation of the stomach gives rise to much confusion except when used in connection with the condition acute dilatation just described. For years special writers have been making an unsuccessful attempt to use the term consistently. All agree that the condition they wish the term to express is inability of the stomach to empty itself in normal time, together with enlargement of the capacity or size of the organ.

Since it is well known that normally functionating stomachs vary greatly in size, some being enormously enlarged, greater emphasis is placed on the inability of the stomach to empty itself than upon the enlargement of the organ. By common consent such a meaning or interpretation is embodied in the term dilatation of the stomach.

In some cases of pyloric obstruction with stagnation of food of high degree, however, the capacity of the stomach is normal or less than normal. The inconsistency of using the term dilatation to express the disturbance in motility alone is apparent. Thus far one term has not been found that expresses clearly the idea of stagnation and the varying capacity that may attend it.

Since an increase in capacity alone has no serious clinical significance (see Megalogastria), the chief interest centered in the term chronic dilatation has to do with the inability of the stomach to empty itself in normal time. (Great clearness of understanding would result if the term chronic dilatation of the stomach could be forgotten.) Arbitrarily seven hours is accepted as the normal time required for a stomach to empty itself of a meal of ordinary size. It is well known, however, that in perfectly healthy individuals the stomach may be found empty in five hours. On the other hand, it is not correct to assume that a serious disorder is necessarily present when one finds actual food eight or nine hours after the ingestion of a motor meal. In connection with other signs and symptoms, however, such lowered motility may signify a moderate degree of pyloric obstruction, or perhaps a relaxation of tonicity of the gastric muscle. The clinical picture designated by the term atony of the stomach has in it the element of lowered motility, but never to the extent of actual stagnation of food overnight.

Chronic stagnation, a condition in which the stomach is unable to empty itself completely during the night, is always indicative of a serious disorder of motility and is easily recognized. An ordinary meal is given at the usual supper time. Actual food in varying quantity is found regularly in the morning before breakfast. The stomach unable to empty itself between supper and breakfast time will also be unable to empty itself during the interval between the other meals; hence a condition of continued retention of food exists. Theoretically, such a disturbance in motility might arise either from primary weakness of the muscle wall of the stomach or from pyloric obstruction. The terms atonic and tonic dilatation of the stomach have been applied to these two forms. It should be understood, however, that primary weakness of gastric muscle or atony of the gastric muscle practically never gives rise to chronic retention of food.

Whenever day after day, upon giving an ordinary meal at supper time, the stomach-tube shows presence of actual food at breakfast time, an obstruction exists at the pylorus in practically every case. The only exceptions are acute dilatation, already described, and rare instances of serious disease of the muscle of the pars pylorica; for example, such as extensive carcinomatous infiltration of that region without actual narrowing of the pylorus.

Ordinary so-called atonic dilatation of the stomach independent of pyloric obstruction is practically never accompanied by retention of food overnight. Whenever such retention occurs regularly, pyloric obstruction exists, with extremely rare exceptions.

PYLORIC OBSTRUCTION

Etiology.—(A) Malignant growths developing primarily in the stomach, or, more rarely, in the duodenum, pancreas, and other adjacent organs.

(B) Benign processes: (1) Ulcer resulting in cicatricial narrowing.

(2) Ulcer, fissure, or erosion located at or near the pylorus, associated with spasm of the pyloric muscle, inflammatory swelling, or local peritonitis. (3) Disease of the gall-bladder and bile-tracts, resulting in plastic exudate or cicatrix involving either duodenum or pylorus. (4) Peritoneal adhesions about the duodenum and pylorus, due to other causes than bile-tract disease, as appendicitis and other forms of local peritonitis. (5) Cicatricial narrowing from caustic acids, alkalies, and corrosive substances. (6) Congenital hypertrophy of the pylorus. (7) Stenosing gastritis, benign adenomata, and polypi.

Peptic ulcer resulting in cicatrix, pyloric spasm, or inflammatory swelling is by far the most common cause of benign pyloric obstruction. Diseases of the gall-bladder and bile-tracts stand next in frequency, although, compared with ulcer and its effects, pyloric obstruction is relatively rarely due to disease of these structures.

A mechanical obstruction of slight grade is overcome by an increase in the propelling force of the gastric muscle, and the contents of the stomach pass into the duodenum in normal time. As the obstruction increases, the gastric muscles, especially in the region of the pars pylorica, undergo physiologic hypertrophy, which may be sufficiently compensatory for a varying period. When the obstruction is relatively greater than the propelling force, food and secretion are retained longer than normal. A portion of the food is retained from one meal until the next during the day, and in the higher grades of obstruction food eaten the day before is found in the stomach at breakfast time. Such a grade of obstruction results in abnormal fermentative changes in the food. (Unless food is thus regularly retained overnight, gastric fermentation of pathologic significance does not occur.) As the obstruction increases, vomiting occurs, particularly vomiting of food eaten on previous days.

Microscopic and chemical analyses show the presence of sarcinæ, if free hydrochloric acid is present, lactic acid, and enormous numbers of long and short bacilli if glandular secretion is lost. Yeast organisms, butyric and acetic acid, and other products of fermentation may be present. The accumulation of food and secretion has a tendency to produce dilatation of the cavity of the stomach and gastroptosis.

Treatment.—Obstruction at the pylorus, resulting in stagnation of food overnight, cannot be completely relieved without surgical operation, except when due to spasm of the pylorus, inflammatory swelling, or local peritonitis. Even a high-grade obstruction from these causes may be readily overcome without operative procedure. (See medicinal treatment of gastric ulcer.) If there are no contraindications, however, surgical operation, usually gastro-enterostomy, with or without resection of the pylorus and adjacent parts, should be performed without delay, when the following conditions exist: (1) Pyloric obstruction due to a removable malignant tumor. (2) Congenital hypertrophic stenosis. (3) Pyloric obstruction due to an acute inflammatory exudate that demands operation for the relief of the local condition, *e. g.*, suppurative cholecystitis or disease of the bile-tracts. It may be sufficient to relieve the local condition without gastro-enterostomy. (4) Pyloric obstruction from any cause of such high grade and of such long duration that the reduced condition of the patient might render operation unsafe after a few days' delay.

In all other cases medicinal management is justified for at least a few days, for the purpose of determining the degree of obstruction, its nature, and whether due wholly or in part to actual anatomic narrowing, pyloric spasm, inflammatory swellings, or local peritonitis. In a given case the conditions may be fairly apparent at the first examination.

The degree of obstruction is best determined by the loss in body-weight, copiousness of the vomit, thirst, duration of the signs of obstruction, and amount of urine. If the daily quantity of urine is reduced to 400 or 500 c.c., associated with a marked loss in weight, and upon giving a motor meal at night and aspirating the stomach in the morning before breakfast 500 c.c. or more of food is found in the stomach, the obstruction is of very high grade. The aspiration of an equal quantity of almost clear secretion might indicate only a moderate degree of obstruction, associated with a continued secretion. Obstruction of high grade and long duration, with evidence of a slight amount of pain and absence of tenderness, is almost surely due to anatomic narrowing. The likelihood that pyloric spasm, inflammatory swelling, or local peritonitis is causing a part or all of the obstruction is suggested by the presence of cramp-like pains, occurring regularly two or three hours after eating, local tenderness in the pyloric region, with or without temperature or leukocytosis, associated with evidence of obstruction of only a few days' or a few weeks' standing.

Since in many cases it is impossible to determine at once to what degree, if any, spasm or inflammatory swelling is contributing to the obstruction, it is well to begin medicinal treatment in all cases in which the indications for surgical treatment as previously outlined are not urgent. The patient should be given rest in bed and exclusive rectal feeding or the administration of salines per rectum for from two to six days, depending on the strength of the patient and the probable cause of the obstruction. If due to inoperable carcinoma, two days should rarely be exceeded. If due to ulcer, six days usually suffices. If no contraindication exists, the stomach should be aspirated now and then during this period until it is determined that all secretion has ceased. When feeding by mouth is begun, a half ounce or an ounce each of milk and cream should be given every hour from morning until night. If the obstruction is due to ulcer, the alkalies should be given midway between each feeding, as in the management of gastric ulcer. Provided there is no pain or retention, the quantity of food at each feeding may be gradually increased, until an adult is given 1½ ounces each of milk and cream every hour, to which may be added during the day three or four soft-cooked eggs, and 9 or 12 ounces of a well-cooked cereal (3 ounces at a feeding, measured after prepared). At no time should more than 6 ounces be given at one feeding. The nearer the food approaches the liquid state, the more readily it passes the pylorus.

The ability of the stomach to empty itself as the food is gradually increased may be accurately tested now and then by using the stomach-tube in the morning before feeding is begun. If the above quantity and quality of food passes the pylorus, the opening is large enough to permit of a rapid gain in weight. The size of the opening may be tested still further if desired at this time by giving a regular motor meal. This should not be done until after the pain and local tenderness have been absent for a week or ten days. If the motor meal shows no retention, then it may be assumed that the narrowing was due wholly or in part to spasm or swelling. The medicinal management of ulcer or inoperable carcinoma, or whatever the case proves to be, may then be continued. If the obstruction is due to actual anatomic narrowing, as the amount of food taken is gradually increased food retention occurs, and usually without a return of pain and tenderness. If under careful management it is impossible for an adequate quantity of liquid nourishment to pass the pylorus, starvation will occur, unless surgical relief is instituted. If retention of food occurs upon giving a motor meal after the careful medicinal management described has been carried out for two or three weeks, and if during the last ten days of that time all pain and local tenderness have subsided, then it may be assumed that the opening is so small that the obstruction should be relieved by surgery, provided no contraindication exists. If the condition of the patient is such that gastro-enterostomy, jejunostomy, or other operative procedure for relief is contraindicated, a fair degree of nutrition may be maintained unless the obstruction is too great.

Gastric lavage should be performed every morning, or every second morning, to remove the stagnating material. Hourly feedings of small quantities of liquid and finely divided foods, as in the early management of ulcer, is usually best tolerated. The intense thirst present in obstruction of high grade may be relieved by the use of salines per rectum. For further details relative to the non-operative treatment of pyloric stenosis, see medicinal management of peptic ulcer and carcinoma of stomach.

CONGENITAL HYPERTROPHIC STENOSIS OF THE PYLORUS

According to Osler, the condition was recognized in 1778. Previous to the last ten years, however, very few cases were reported. Recent literature shows that the condition is not rare. The pyloric orifice is narrowed by great hyperplasia of the muscular and submucous coats in that region. The greatest hyperplasia is usually found in the circular muscle-fibers. The overgrowth of tissue at the pylorus may extend a short distance into the duodenum. In rare instances the whole stomach wall is involved. The cavity of the stomach is usually enlarged. The pylorus feels like a hard cylinder.

Etiology.—The condition is not satisfactorily explained. It is assumed by some that the muscular hyperplasia is a local overgrowth developing independent of disease elsewhere. Others believe the hyperplasia develops secondary to often repeated spasmodic contraction of the pyloric muscles. It is noteworthy that pyloric hypertrophy has not as yet been observed in the fetus.

Course.—The condition develops rapidly, as a rule, although acute and chronic cases are distinguished. At birth the child is apparently normal; soon afterward, often during the first or second day, or perhaps not until the second, third, or fourth week, vomiting occurs after nursing. At first only a small quantity of nourishment may be lost. The quantity vomited is likely to increase from day to day until finally very little food is retained. The administration of even a teaspoonful of liquid may excite vomiting. The loss in weight is progressive; the temperature is subnormal; constipation exists, and the urine is greatly reduced in amount.

After pronounced symptoms have been present for a few days the outlines of the stomach may be distinctly visible through the presence of peristaltic waves. A hard, movable, cylindric tumor may be felt in the region of the pylorus. Emaciation finally becomes extreme and death occurs from exhaustion.

In acute cases death may take place in from a few days to two or three weeks. In the more chronic cases symptoms may not appear for several weeks or months after birth. Subsequently the development of the condition may be slow. Serious manifestations are delayed for years in exceptional cases.

Treatment.—The experience of Heubner, Batten, Coates, Senator, and others shows that the condition may be overcome in some cases by medicinal management. In many cases the act of nursing seems to provoke gastric peristalsis, and vomiting immediately follows. When this occurs, it is advisable to pass a small rubber catheter through the nose into the stomach and introduce 1 or 2 ounces of the mother's milk or modified milk, gradually increasing the quantity if it is retained. The usual rules relating to the modification of milk and frequency of feeding should be followed as closely as possible.

Once or twice daily the stomach may be irrigated with warm water containing one teaspoonful of sodium bicarbonate to the pint. If the stomach empties itself completely, it is not necessary to employ lavage. After the vomiting has ceased for a few days, the attempt should be made gradually to substitute feeding by mouth for the nasal method.

Warm applications to the epigastric region and absolute body rest have a quieting influence on the excessive peristalsis.

If no relief is afforded by medicinal measures, surgical treatment should be adopted before exhaustion increases the danger of the operation. In the light of our present experience it is very probable that in the majority of cases in which serious symptoms are present the condition should be treated surgically. Early recognition and the prompt employment of nasal feeding might materially influence the results of medicinal treatment.

The surgical measures advocated are pylorodiosis, or stretching the pyloric orifice, as devised by Loreta; pyloroplasty, and gastro-enterostomy. The operation selected is determined by the conditions presented by the individual case. Each method of procedure has resulted in complete recoveries. Late recognition of the condition has contributed to the high mortality of operative treatment.

SIMPLE ENLARGEMENT OF THE STOMACH (Megalogastria)

This condition is independent of pyloric obstruction or other evident anatomic disease or altered functional activity of the stomach. Simple enlargement, or megalogastria, must not be confused with clinical dilatation of the stomach, a condition in which abnormal retention of food and secretion contributes to the enlargement of the organ. The capacity of the normal stomach is about 1800 c.c. When moderately distended with gas, the lower border of gastric resonance is from 3 to 5 cm. above the umbilicus. The distance from the lower to the upper border varies from 10 to 14 cm. Unless gastroptosis is present, it is difficult to locate the upper border accurately by percussion.

In simple enlargement the measurements and capacity of the stomach are greater than normal. In some cases the size is enormous, the lower border extending nearly or quite to the pubes, the upper border being approximately in normal position. The enlargement may be congenital or acquired. The condition is relatively common. The motor and secretory power being normal, subjective symptoms are usually absent and treatment is not required.

FUNCTIONAL DISORDERS OF THE STOMACH

Under this heading will be considered the disorders of the stomach that arise independent of demonstrable anatomic disease of that organ. In the light of our present knowledge, this group of clinical manifestations is very probably dependent largely upon disorders of the nervous system. Hence, such terms as "neuroses of the stomach," "nervous disorders of the stomach," are applied. These various clinical manifestations may be grouped as follows: Disorders of secretion, motility, and sensation, and nervous dyspepsia.

DISORDERS OF SECRETION

HYPERCHLORHYDRIA

The term hyperchlorhydria designates a complexus of symptoms arising from the secretion of an excessive quantity of hydrochloric acid at the time food is present in the stomach.

Gastric secretion ceases as soon as the food leaves the stomach.

Hyperchlorhydria is sharply differentiated from continued secretion, a condition in which the secretion of gastric juice takes place not only when food is present in the stomach, but also for hours and even days after the stomach is free from food. The complexus of symptoms termed hyperchlorhydria constitutes one of the most common disorders of digestion. Normally, the secretion of hydrochloric acid and the gastric ferments begins with the ingestion of a meal. The hydrochloric acid secreted combines with the food until all of the albumin has become saturated. More hydrochloric acid than is required is secreted and the excess appears as free or uncombined hydrochloric acid. Under normal conditions the free hydrochloric acid and total acidity ranges from 20 to 40 and from 40 to 60 respectively, in terms of decinormal sodium hydrate. Hyperchlorhydria is said to exist when the hydrochloric and total acidity are greater than normal. A total acidity of 80 associated with a free hydrochloric acidity of 55 or 60 is considered a moderately high-grade hyperchlorhydria.

When free hydrochloric acid appears in excess of the normal amount, epigastric discomfort may result. It is the excess in free acid that causes the greatest irritation. Hence the greatest discomfort appears at the height of digestion and disappears as the food and secretion enter the duodenum and are neutralized by the alkaline intestinal secretions.

In uncomplicated cases discomfort is absent in the morning before breakfast, at the time of eating, and immediately afterward. Discomfort appears from half an hour to two or three hours after eating, depending upon the quantity of albumin present in the meal, the rapidity with which the secretion is poured out, and the sensitiveness of the nerves of the mucous membrane.

The clinical manifestations vary from a feeling of epigastric fullness, pressure, weight, or burning to real painful sensations. Eructations of gas, heartburn, and acid pyrosis are common manifestations. At the height of digestion rarely nausea and vomiting may occur. Symptoms may be present one day and absent the next, or they may continue with regularity for weeks and even months, but discomfort rarely follows every meal during the entire period.

In many cases hyperchlorhydria symptoms are present, and upon examination a normal quantity of hydrochloric acid is found. In such cases the nerves of the mucous membrane are over-sensitive to acids. The same treatment is required.

Less frequently excessive hydrochloric acidity is present without symptoms—latent hyperchlorhydria.

Etiology.—Anatomic diseases of the stomach causing hyperchlorhydria, such as ulcer and gastritis, have already been considered. Nervous and neurasthenic individuals are predisposed to the manifestations of hyperchlorhydria.

Of the causes that may be controlled, the most important are mechanical, chemical, and thermal irritants in the form of food and drink and excessive smoking.

Treatment.—The results of the treatment of hyperchlorhydria are extremely satisfactory. If insomnia is present, sleep should be induced. The patient should be made as free from nervous worry as possible. The symptoms frequently appear or become greatly aggravated because of worry or fatigue. A period of rest or a temporary change in surroundings may be sufficient to cause the symptoms to subside. If the nervous element is marked, 30 or 40 grains of bromid of strontium or sodium may be given daily. Fortunately, however, by careful attention to diet alone very little drug or other treatment is required to control the manifestations of the disorder.

In true hyperchlorhydria a vicious circle is established. Excessive gastric secretion is excited by the presence of food. The excessive acidity irritates the nerves of the gastric mucosa and the glands respond to the normal stimulus, food, by pouring out excessive secretion, which renders the gastric mucosa irritable. A diet should be selected that excites the least secretion, combines the maximum amount of hydrochloric acid, and given in such a state of fine subdivision that it quickly passes on into the duodenum. Mechanical, chemical, and thermal irritants should be avoided, particularly at the time the disorder is present, and at all times by individuals subject to frequent attacks. Coarse particles of food act as mechanical irritants because they are dissolved slowly or not at all by the gastric juice, and remain in the stomach longer than fine particles, and thus excite an undue amount of secretion. The nearer food approaches the liquid state, the more rapidly it passes the pylorus. Such articles of diet as potato salad, pickles, fried potatoes, raw apples, radishes, and raw onions should be avoided. Coffee, alcohol, vinegar, lemonade, strong acid fruits, pepper, mustard and other sharp condiments are the common chemical irritants that should be avoided. Excessive smoking is a common cause of hyperchlorhydria. Thermal irritants, such as extremely hot and cold drinks and highly seasoned hot soups, should be avoided. All food should be mechanically reduced to a fine state of subdivision previous to mastication.

The following diet is palatable, nourishing, and successfully meets the indications in the majority of cases:

An adult, weighing 160 pounds, is given from ¼ to ⅓ pound of lean meat, such as steak, roast beef, lamb, veal, chicken, or turkey, well teased apart with knife and fork, two slices of toast or zwieback, with butter, and a glass of equal parts of milk and cream three times daily for four or five days. Well-cooked rice, oatmeal, or farina, with cream and sugar, may then be added if desired. After two days more may substitute soft egg for a portion of the lean meat and add mashed potatoes and other vegetables in purée form. After the first few days, if desired, the lean meat may be discontinued, and soft eggs, milk and cream, cereals, and vegetable purées made the basis of the diet for a period of two or three weeks, when, as a rule, the patient may return to an ordinary diet, being careful to avoid the mechanical, chemical, and thermal irritants described. During the first ten days or two weeks of the management it is usually desirable to give about 30 grains each of sodium bicarbonate and calcined magnesia in one-half glass of water, about two and a half or three hours after meals, for the purpose of neutralizing the excess of acid, and overcoming the tendency to constipation that often arises from giving a diet containing such a small amount of residue as that used in the early management of the disorder. If an uncomfortable peristalsis of the bowel or profuse diarrhea results, the quantity of powder should be lessened or none taken for a day or two.

In uncomplicated cases, unless the nervous element is unusually pronounced, the diet alone gives prompt relief. Magnesia and soda, however, should be prescribed and the patients admonished to take these alkalies, particularly if discomfort appears at the usual time, two and three hours after eating. It should be explained to them that the object in taking the powder is not alone to make them comfortable, but to aid the diet in controlling the acidity, and thus lessen the irritability of the mucous membrane of the stomach.

The after-treatment is of very great importance, particularly when dealing with nervous and under-nourished patients. A system of forced feeding nearly always results in benefit. The eggs, milk, cream, cereals, and vegetable purées should be continued in sufficient quantity, usually until the patient has regained his previous maximum weight, and unless this amounts to an actual overweight, a few pounds more may well be added.

If constipation exists after the magnesia and soda are discontinued, a sufficient quantity of laxative foods should be included in the diet, such as rye and graham bread, apple sauce, stewed fruits, and marmalades of various kinds, and a liberal quantity of potato. If necessary, various vegetables, rich in cellulose, such as spinach, carrots, parsnips, and squash, may be given. Constipation may be a factor in the production of the hyperchlorhydria complexus of symptoms.

Finally, the patient should be warned that if in the future indiscretion in diet, fatigue, worry, or various other conditions cause a return of the discomfort, the strict diet and management outlined should be resumed at once.

Taken thus early, the symptoms usually disappear quickly. Few distressing conditions yield so promptly to proper management as the hyperchlorhydria complexus of symptoms when unassociated with anatomic disease.

The diagnosis should be carefully reconsidered in all cases that fail to respond within a reasonably short time after treatment is begun. Peptic ulcer and gall-bladder disease are frequently associated with a clinical picture simulating closely the hyperchlorhydria complexus of symptoms.

Continued Secretion—Hypersecretion

Normally, the presence of food in the stomach stimulates the secretion of gastric juice. When the food leaves the stomach, secretion ceases. When continued secretion exists, the glands of the stomach pour out their physiologic secretion independent of the presence of food. In the morning before breakfast from 75 to 500 c.c. or more of gastric juice is found in the stomach.

Two distinct forms of the condition should be differentiated:

1. Continued secretion resulting from obstruction at the pylorus.
2. Continued secretion resulting from purely nervous influences.

Clinically, continued secretion is most frequently found in connection with obstruction at the pylorus. The anatomic condition is usually ulcer with pylorus spasm or a cicatricial narrowing at the pylorus. This form of continued secretion has been discussed in connection with gastric ulcer.

As a purely nervous condition, continued secretion is relatively rare. It occurs chiefly as a transitory or periodic affection—gastrosuccorrhea periodica (Reichman), gastroxynsis (Rossbach).

The exact nature of the underlying condition is uncertain. The excessive glandular activity may be due to a secretory neurosis, reflex neurosis, or disease of the central nervous system, such as tabes or myelitis. The symptoms are due to the irritation of the gastric mucosa by the excessive quantity of hydrochloric acid secreted. Gastric distress, even cramp-like pains, nausea, and the vomiting of a considerable quantity of strongly acid gastric juice, may continue for three or four days.

Rossbach described a type of cases in which the attack is preceded by a severe headache.

The condition seems to appear chiefly in neurotics and individuals under severe mental strain. The attacks may be widely separated or occur with frequency. The condition must be differentiated from the gastric crises of tabes and the periodic vomiting of von Leyden.

Treatment.—The general management advised in the treatment of hyperchlorhydria should be instituted. At the time of the attack calcined magnesia and sodium bicarbonate should be used to neutralize the acidity. If all feeding by mouth be withheld, the secretion usually ceases in one or two days. Liquids should be supplied by giving salt solution per rectum.

Chronic continued secretion (gastrosuccorrhea chronica—Reichman) very rarely, if ever, occurs except as a symptom of partial obstruction at the pylorus. Riegel and others, however, believe that a chronic continuous flow of gastric juice may result from excessive irritability of the gastric glands, independent of organic disease of the stomach.

ACHLORHYDRIA

The secretion of hydrochloric acid may be entirely suspended under the influence of the nervous system. In such cases, if no anatomic disease of the stomach is present, the gastric proenzymes are usually secreted in normal quantity. If the proenzymes are absent, the clinical manifestations are practically the same as in atrophic gastritis. The term achylia gastrica was applied by Einhorn. Further study will be required to demonstrate the existence of achylia gastrica as a distinct clinical and anatomic disorder.

From the standpoint of prognosis, if no acid is secreted and the proenzymes are present, there is a possibility of great improvement in secretion. If upon repeated examination the proenzymes are absent, an improvement in secretion is very improbable.

The treatment of achlorhydria and achylia gastrica does not differ essentially from that advised for atrophic gastritis.

Fortunately, very little, if any, gastric discomfort arises from diminished or absent gastric secretion.

DISORDERS OF MOTILITY

Nervous Vomiting

Vomiting is said to be nervous in origin when it occurs independent of anatomic disease of the stomach. Three forms of nervous vomiting are distinguished. It may be, and most commonly is, *reflex* from disease of the genital organs, pharynx, larynx, kidney, liver or bile-tracts, intestine, appendix, peritoneum, and nasal mucous membrane. It may be due to *anatomic disease* of the cerebral or spinal nervous system, as in tabes, myelitis, and brain tumor. It may be a manifestation of *hysteria* or *neurasthenia*.

Juvenile vomiting, the *vomiting of pregnancy*, the *gastric crises of tabes*, and the periodic vomiting, described first by von Leyden, are special forms of nervous vomiting.

Stiller emphasized the following points frequently observed in nervous vomiting: It often occurs without effort and independent of the quality and quantity of food ingested, or when the stomach contains no food. Certain peculiar, often bizarre, substances may be retained. Elective vomiting often occurs in that certain substances from a mixed diet may be regularly ejected. Other nervous manifestations are usually present.

Prognosis.—Periodic, juvenile, or tabetic vomiting usually ceases in from two or three to ten days. In rare instances the vomiting of gastric crises persists for weeks and months. The vomiting of pregnancy often becomes extremely serious, and may result in abortion, miscarriage, and even death.

Treatment.—In all cases of nervous vomiting the cause should be sought and, if possible, removed. When the cause cannot be found or removed, the condition must be treated symptomatically. In severe cases rest in bed should be instituted and all food withheld for two or three days. Liquids should be supplied per rectum. As a rule, solid foods, such as meat, soft egg, rice, and toast, are retained better than liquids. A small quantity should be given at first, and if tolerated the amount given at each feeding may be increased. Small pieces of ice may be given alone or with the addition of 5 drops of chloroform every hour. Iced champagne is sometimes effectual. Ten drops of ether every hour, 2 or 3 grains of menthol in a teaspoonful of brandy given with cracked ice three times daily, 10 drops of tincture of belladonna three or four times daily, 2 teaspoonfuls of a 2 per cent. solution of cocain hydrochlorate every hour for two or three doses, 5 grains of oxalate of cerium every two hours, 5 grains of antipyrin every three hours, 10 grains of bromid of sodium in an ounce of milk three or four times daily, are among the drugs that may be used. In some cases, particularly in tabetic crises, one is justified in giving $\frac{1}{6}$ or $\frac{1}{4}$ of a grain of morphin sulphate, with $\frac{1}{100}$ of a grain of atropin sulphate, subcutaneously. Counter-irritation with mustard and heat or cold applied to the epigastric region is often beneficial. Suppositories of cacao-butter, each containing ¼ grain of extract of belladonna and ½ grain of phosphate of codein, may be inserted every two or three hours during the attack.

During the interval in gastric crises Boas uses 6 grains each of iodid of sodium and bromid of sodium or ammonium in milk, three times daily. The galvanic current, anode over the stomach and cathode over the spine, is of value in some cases.

Gastric lavage is sometimes beneficial. No doubt the effect is largely mental.

For the vomiting of pregnancy local treatment is seldom required, except when tumors are present or a retroflexed uterus is incarcerated. If, notwithstanding absolute rest in bed and the intelligent application of all measures, the vomiting continues, serious insomnia begins to develop, the body-weight begins to diminish rapidly, and the pulse-rate becomes accelerated, pregnancy should be interrupted before it is too late. It is a significant fact, however, that in well-regulated institutions it very rarely becomes necessary to interrupt pregnancy because of hyperemesis.

Peristaltic Unrest of Kussmaul

Normally, the contractions of the stomach and intestines are not visible except when the abdominal wall is very thin and relaxed. The elevations of the thin abdominal wall thus produced seldom exceed ¼ inch in height, and change position rapidly, rarely persisting at one point longer than a second. Abnormal peristaltic waves may be seen through a thick abdominal wall. The elevations of the abdominal wall may be from ½ to 5 inches or more in height. They persist usually for several seconds and are likely to travel wave-like in one direction. Wave follows wave over the same area. Gurgling of liquid and gas and colicky pains are likely to accompany the movements. The patient is frequently conscious of something moving inside the abdomen. Such abnormal peristaltic contraction confined to the muscular wall of the stomach is due in the vast majority of cases to pyloric obstruction from organic disease at or near the pylorus, either with or without pylorus spasm.

In very rare instances the excessive irritation caused by hyperchlorhydria may result in the production of visible peristaltic waves, possibly by inducing obstruction from spasm of the pyloric muscle.

Visible peristaltic waves may be the result of a motor neurosis. Such cases, however, are exceedingly rare, and should not be diagnosed as such until pyloric obstruction has been positively excluded.

Treatment.—In the purely nervous or Kussmaul form of gastric tormina the general nervous system should be improved. Belladonna, bromids, and the faradic current may be used.

Nervous Eructations

Individuals afflicted with nervous eructations swallow air or aspirate it into the esophagus and stomach and expel it with annoying frequency. In some cases marked paroxysms of belching occur, particularly under the influence of excitement, worry, or overwork. Those afflicted may be obliged to shun company because of the embarrassment caused by a more or less constant belching, which may occur only in the presence of others. The condition arises independent of organic disease of the stomach, and is not often influenced by the presence of food in the stomach or the state of the gastric secretions.

Treatment.—It is frequently sufficient to convince the patient that the accumulation of gas in the stomach is not due to disease of that organ and to draw attention to the manner in which the air is aspirated or swallowed and eructated. Nervous worry and over-excitement and other causes must be sought and removed, if possible. Nerve sedatives, such as the bromids, may be administered.

RUMINATION AND REGURGITATION

Rumination and regurgitation are closely allied. In both the food returns to the mouth from the stomach without nausea, vomiting, or apparent effort. Rumination is said to exist when the food thus returned is again masticated and swallowed or simply swallowed. If it is expelled, the act is called regurgitation. Either condition, occurring independent of anatomic disease of the esophagus or stomach, is rarely serious enough to demand special treatment.

PYLORIC INSUFFICIENCY

The pyloric muscle is usually relaxed when the stomach is empty. When filled with food, liquid, or air, the pylorus contracts and retains the contents for a variable time. The pylorus is said to be insufficient when the orifice is relaxed, so that it is impossible to distend the stomach with gas.

The condition may be due to anatomic disease of the pylorus, such as cicatrix or carcinoma, or abnormal relaxation of the pyloric muscle may result from a disordered nervous system.

As a purely nervous condition, pyloric insufficiency does not require treatment.

DISORDERS OF SENSATION

GASTRALGIA

The term gastralgia is applied to attacks of epigastric pain in which the stomach is involved.

Among the causes of gastralgia may be mentioned disease of the stomach, of the central nervous system, intoxications, reflex disturbances arising from disease of adjacent organs, neurasthenia, and hysteria. Gastralgia due to ulcer, cancer, hyperchlorhydria, perigastritis, epigastric hernia, gastric crises of tabes, myelitis, nicotin, intoxication, anemia, retroflexion of the uterus, and disease of adjacent organs will not be discussed here.

Gastralgia on a purely nervous basis, independent of tabes, is so exceedingly rare that all possible causes of epigastric pain must first be carefully excluded before assuming that a nervous gastralgia is present. Gall-stone colic, through error, is frequently diagnosed gastralgia.

Treatment.—The patient should go to bed and heat should be applied to the epigastric region. Five or 10 grains of aspirin may be given every three or four hours. The galvanic current, anode over the stomach and cathode over the spine, for five or ten minutes, is of value.

It is rarely necessary to resort to the use of morphin.

BULIMIA

Bulimia is a term used to express an abnormally great hunger. The sensation may appear in such diseases and conditions as gastric ulcer, hyperacidity, and even in gastric carcinoma. More clearly as a neurosis it may appear in exophthalmic goiter, diabetes, pregnancy, hysteria, neurasthenia, epilepsy, and the various psychoses.

ACORIA

Acoria is a term used to express an insatiable appetite. The feeling of hunger may not be great and even anorexia may be present. The symptom is most frequently found in neurasthenia and hysteria.

Treatment.—The general nervous system should be improved, if possible. Small doses of the bromids, either with or without opium and belladonna, have a tendency to reduce the appetite in bulimia.

ANOREXIA

In many of the anatomic and in a few of the functional diseases of the stomach the appetite is reduced or lost. Anorexia is a common symptom in diseases of various kinds in which the stomach is not directly involved, such as Bright's disease, tuberculosis, carcinoma, etc.

Anorexia, as a purely nervous disorder, may occur from psychic disturbances, such as mental depression, sorrow, fright, anger, or from sensory impressions, such as pain, disagreeable odor or taste.

Chronic anorexia without apparent cause may exist from childhood and more or less successfully resist all effort to overcome it.

Treatment.—Children may be taught to eat. Smoking frequently reduces the appetite. Life in the open air is the very best appetizer at our command. With proper precautions the bed-ridden may spend a few hours each day on porches or in open tents.

Water or liquids should be freely taken during the meal. A sip of water, milk, coffee, or tea, or a bit of sauce frequently taken during the ingestion of a meal, may serve to whet the appetite to a marked degree. Mustard, pepper, and other sharp condiments are frequently of value. A small amount of alcohol in the form of wine, whisky, or brandy, well diluted and taken at frequent intervals during the meal, usually stimulates the appetite. In all cases much depends upon skilful preparation of the food.

In obstinate cases of nervous anorexia it may be necessary to change the whole life and surroundings of the patient temporarily. Many under-nourished neurasthenics learn to relish food when put to bed in charge of a trained nurse who is able to give massage and prepare palatable dishes and force them to eat sufficient nourishment to cause a gain of 2 or 3 pounds each week. The value of fresh air should not be forgotten in the management of such cases.

Cases of insanity that cannot be made to eat should be fed milk, cream, eggs, and grape-sugar by a catheter introduced into the esophagus through the mouth or nose. It frequently happens that after the patient has gained a few pounds in weight the appetite returns.

Of drugs that increase the appetite, the bitter stomachics are of the most value. Five or 10 drops of the tincture of nux vomica and gentian in a teaspoonful of the syrup of orange peel, or other bitter drugs, such as cinchona, condurango, and rhubarb, may be given. Preparations of iron and arsenic are of special value in the treatment of anorexia occurring in the anemic. A few drops of creasote combined with the tincture of gentian, well diluted with water, often increases the appetite in tuberculous patients. Orexin is of value in some cases. As a rule, the drugs should be given about fifteen minutes before meals.

Nervous Dyspepsia

Much confusion is centered about the term nervous dyspepsia. This may be largely avoided by confining the term to a complexus of symptoms characterized by various forms of epigastric discomfort occurring during the period of digestion in cases in which there is no anatomic disease or derangement of function of the stomach. A test-breakfast shows normal secretion and motility. The most varied and fluctuating symptomatology may be presented. The quality of food usually has but slight influence on the discomfort. In most cases a feeling of fullness, pressure, or weight appears during or immediately after the ingestion of a meal. Pain is rarely present.

In the vast majority of cases the condition is but a part of a general disorder of the nervous system. Because of the discomfort after eating an insufficient quantity of food is usually taken, and malnutrition, muscular weakness, and constipation are frequently added to the condition. A great many of the cases belong to the Stiller type of individuals, those congenitally weak in physical development, inclined to neurasthenia, anemia, visceroptosis, and constipation. Much less frequently nervous dyspepsia is present in well-nourished individuals.

Treatment.—The two classes of cases must be distinguished. The ordinary treatment for neurasthenia should be instituted in the well-nourished cases of nervous dyspepsia. In addition, the poorly nourished should be put on a system of forced feeding that insures a gain in weight of from 1 to 3 pounds per week. Unless the physician in charge has the courage of his convictions, considerable difficulty may be experienced in bringing this about. Frequently the appetite is poor and the patient hesitates to eat because he has always restricted his diet, on account of the discomfort produced. The measures advised in the management of anorexia should be adopted and the patients warned that they must expect to feel distended and perhaps uncomfortable during the first few days of treatment. After a short time the discomfort incident to the taking of an increased quantity of food ceases.

The number of calories required to sustain the body-weight should be at least roughly estimated, and from one-third to one-half more should be given, preferably in the form of milk and cream, bread and butter, well-cooked rice and oatmeal, mashed potatoes, and eggs.

If constipation is present, it is usually advisable first to relieve it by laxatives, such as cascara sagrada, and subsequently, as the patient learns that he is able to eat without discomfort and is encouraged by a gain in weight, it is usually easy to add to the diet a sufficient quantity of food rich in cellulose to relieve constipation. If anemia is present, a combination of iron and arsenic is valuable.

If insomnia is present, it should be controlled by the use of bromids, veronal, and other mild hypnotics.

In the very nervous cases the best results are obtained by rest in bed, massage, and forced feeding, in charge of a trained nurse. After a period of about three weeks, gentle and gradually increasing exercise may be substituted. The forced feeding should be continued until a gain of from 10 to 30 pounds or more is recorded.

The results of treatment are usually exceedingly satisfactory. The gain in weight and strength produces a pronounced mental effect upon the patient, which contributes much to the success of the treatment. The nervous discomfort is likely to disappear as the patient increases in weight and strength. As a rule, patients soon learn to ignore whatever discomfort may remain.

It is very important to keep the patients under observation for several weeks and months after a period of decided improvement, in order that any tendency to a return of the condition may be controlled as promptly as possible.

SURGERY OF THE STOMACH AND DUODENUM

By William J. Mayo, M.D., F.R.C.S., D.Sc., LL.D.

CANCER OF THE STOMACH

Cancer of the stomach is a surgical disease. There is no medical side to the question, unless the drug palliation of incurable diseases can be so called. Comprising as it does 30 per cent. of all cancers of the human body, and because it has been looked upon from a purely medical standpoint, the death-rate from this disease has been 100 per cent. It is time for the medical profession fully to understand that the medical man should seek surgical consultation upon the suspicion of gastric cancer exactly as he would do if the disease was of the lip, breast, or uterus, and it is essential that the physician and the surgeon should act together in complete harmony, in order that the patient may have a chance for his existence.

Compared with appendicitis, extrauterine pregnancies, etc., malignant infiltration of the stomach is more imperatively surgical, because the other diseases present a considerable number of spontaneous cures.

An early diagnosis of cancer of the stomach cannot be arrived at by medical means. The most that can be gained by such examination is to arouse suspicion, and if this cannot be disproved, exploratory incision should be adopted. When we waited to see if bullet wounds of the abdomen involving the hollow viscera had perforated before treating them, the mortality was frightful. In civil practice, at least, the change of sentiment is now so great that a physician who does not have such patients explored at once is considered to have failed in his duty.

Cancer of the pyloric end of the stomach and of the lesser curvature occurs in about 70 per cent. of the total number, and this is about the percentage which, with an early discovery, might be considered surgically. The diagnosis in this group of cases is aided materially by mechanical symptoms due to obstruction, which calls the attention of the patient to his trouble in the early stages.

Cancers of the upper half of the vertical portion of the lesser curvature and of the fundus do not give rise to obstructions, and are, therefore, seldom diagnosed during the operable period. These cancers form 20 per cent. of the total number; in the remaining 10 per cent. the cardiac orifice is the site of the neoplasm, and at the present time does not offer a reasonable prospect of radical extirpation.

The indication for surgical intervention is based upon the fact that cancer exists. Should the condition be beyond the possibility of radical cure, the question of palliation remains; but this is of far less importance, as it merely prolongs by a few weary months a hopeless invalidism.

The presence of a movable tumor in the pyloric end of the stomach is not a contraindication to extirpation, and because of the introduction of mechanical symptoms, removal may be instituted before it is too late. A fixed growth, on the contrary, would be an argument against operation.

A previous history of ulcer with secondary malignant degeneration is often favorable, other things being equal, because on account of the scar tissue, the growth may be of less rapid progress. In over three hundred resections of the stomach for cancer done in our clinic (C. H. and W. J. Mayo), Wilson and MacCarty found 71 per cent. of the cancers to have had their origin on chronic calloused ulcer.

A marked cachexia, free fluid in the peritoneum, carcinomatous glands in the supraclavicular space, and implantation carcinoma in the bottom of Douglas' pouch felt through the rectum, prohibit an attempt at radical cure, and render a palliative operation of questionable propriety.

Cancer of the pyloric end of the stomach has two principal methods of extension: First, by the lymphatics; second, by continuity and contiguity of structure. Metastasis by embolism and peritoneal grafting indicate a late and unoperable condition. A moderate amount of adhesions does not add seriously to the difficulties and dangers of extirpation. But adhesions act as avenues of carcinomatous infiltration, and if they are close in character, especially to the pancreas, they will add largely to the mortality as well as reduce the percentage of cures.

Haberkant showed a mortality of over 75 per cent. after radical operations with marked adhesions, and Mikulicz showed a mortality of 74 per cent. when there were attachments to the pancreas. In our experience we have not found pancreatic complications in the operable cases to increase the mortality to any such extent.

Cuneo has made a close study of the lymphatics of the stomach, and he has established the fact that there are comparatively few glands along the lesser curvature; that these few are set on the pyloric half with the artery and vein, or some little distance from the gastric wall, and that this lymphatic circulation is from left to right. Hartman has taken advantage of this knowledge, and unless the extent of the growth prevents, he saves the greater curvature as far to the left as these lymphatic nodes, which greatly facilitates the subsequent restoration of the continuity of the gastro-intestinal tract. Cuneo further demonstrated that on the lesser curvature the lymphatic structures lay in the wall of the stomach itself, and thereupon Mikulicz was able to establish the dictum that in every case of radical excision of cancer of the stomach the entire lesser curvature to the gastric artery must be removed.

Kocher has called attention to the necessity of removing the group of glands about the pylorus, especially in the groove between the head of the pancreas and the duodenum, where they lie with the distribution of the gastroduodenal artery. The fourth group of glands consists of two or three nodes along the superior pyloric vessel.

The dome of the stomach does not communicate, to any great extent, with the lymphatic arrangement of the pyloric portion, but drains into a few glands in the splenic area, and especially into those about the cardia. The general receiving glands for the gastric group lie about the celiac axis, and the aortic gland, and involvement of these deep glands contraindicates an attempt at radical operation.

In the early stage of the disease the entire pyloric end of the stomach with its lymphatic apparatus can be removed *en masse*. The diseased process usually cuts off directly at the pylorus, and invasion into the duodenum is comparatively rare; but, as pointed out by Robson, wandering carcinoma cells may be found a centimeter or two beyond the growth in the duodenum. It is wise, therefore, in resecting to leave a free margin of apparently normal duodenum on the side of the growth to prevent the possibility of a return at this point.

Pylorectomy and partial gastrectomy was first performed by Péan in 1879, by Rydygier in 1880, and Billroth had the first successful case in 1881.

Billroth established two methods of gastric resection, and they differ from each other in the manner of effecting the juncture between the intestinal canal and the gastric stump. The first method was to sew the cut end of the duodenum into the gastric stump at its lowest part. In order to do this it was necessary to narrow the gastric end by a series of sutures until it was reduced to the size of the duodenal fragment. At the point where the circular line of sutures met the transverse line of sutures, leakage was so frequent that it received the name of the "fatal suture angle." Kocher modified this method in a most noteworthy manner by completely closing the amputated stomach with continuous sutures and inserting the open end of the duodenum at a new point on the posterior surface of the gastric stump. This method has given most excellent results in the hands of its illustrious originator. The second method seems to be the one suitable for the average case. It consists in completely closing both the stomach and duodenal ends and making an independent gastrojejunostomy. This is the method we prefer.

The earlier gastric resections were attended by an enormous mortality. Previous to 1887 the death-rate ranged from 60 to 70 per cent.; from 1887 to 1890 there was considerable improvement, due to the more general acceptance of antiseptic methods of treatment, and the mortality ranged from 30 to 40 per cent. Since the year 1900, with the development of aseptic methods, together with the use of holding clamps to facilitate the suturing and prevent leakage, the mortality has been still further reduced, and now ranges under 10 per cent.

Sixteen per cent. of Mikulicz's cases of resection lived beyond three and one-half years. Kocher had cases alive for fifteen years, and at various periods between that and three years. Kocher calls particular attention to the statement that fourteen months is the average length of life of those who die from recurrence, and that practically all of these patients maintain good mechanical gastric function to the last. Krönlein has had a considerable percentage of cases that have lived beyond three years.

In the 310 resections performed in our clinic up to January 27, 1911, there were 38 deaths, or 12.1 per cent. During the years 1909 and 1910 there were 90 resections, with 8 deaths, or 8.8 per cent.

With the knowledge that 25 per cent. of patients who are operated upon will live beyond three years, and that practically all of those who recover will have from fourteen to eighteen months of comfortable existence, it does seem as though radical operation for cancer of the pyloric end of the stomach is a procedure quite as justifiable as the operation for cancer in other parts of the body.

For pyloric obstruction due to malignant disease which cannot be removed, gastrojejunostomy furnishes a palliation. If the parts are fairly movable, a posterior suture operation uniting the jejunum within 3 or 4 inches of its origin to the posterior wall of the stomach, is the method of choice. It rather frequently happens that the fixed condition of the tumor makes anterior gastrojejunostomy the operation to be considered. For obstruction of the cardiac orifice of the stomach, gastrostomy is indicated, but should be done only when the patient elects, after a full explanation has been given him. The Witzel and Stamm-Kader methods of gastrostomy are among the most popular and easy of performance. However, both gastrojejunostomy and gastrostomy for the palliation of inoperable malignant disease have a considerable mortality, depending upon the degree of starvation and cachexia of the individual patient.

Upon exploring for gastric cancer it frequently happens that a wholly inoperable condition is disclosed, yet one in which there is no obstructive phenomena to lead to the necessity of palliation. Under such circumstances the abdomen should be closed with catgut and buried silk or linen mattress sutures in the aponeurosis, and the patient allowed to return home to spend the remaining days of his existence with his family and friends.

ULCER OF THE STOMACH

Without going into the etiology of gastric and duodenal ulcers, two factors are of sufficient importance to demand attention, and are necessary to the proper understanding of the surgical side of the subject.

First: Duodenal ulcers are more common than gastric, and both duodenal and gastric are more common in the male than in the female. In 1000 cases operated upon at St. Mary's Hospital for gastric and duodenal ulcers, which includes all the cases operated upon up to January 17, 1911, 745, or 74.5 per cent., were males, and 255, or 25.5 per cent., were females.

A large majority of gastric ulcers are situated in the pyloric third of the stomach, especially near the lesser curvature. In this part the muscular action grinds up the food-mass, in contradistinction to the two-thirds lying to the left, which comprises the fundus, with the function of storage and maceration. The enormous frequency of gastric ulcer in the pyloric end of the stomach may in some way be connected with the traumatism received in the grinding process.

Second: The presence of an excess of acid gastric secretions, and, whether cause or effect, the corrosive action that results, is of the utmost etiologic significance. This is shown by the development of duodenal ulcers in the first 2½ inches of the duodenum below the pylorus, well above the common duct with its alkaline secretions. Further, these changed secretions will occasionally produce a typical jejunal ulcer near the point of a gastrojejunostomy which had been made for the original lesion. The great importance of traumatism and acid gastric secretions in the development of ulcer is shown by the favorable effect of gastrojejunostomy made to the left of the muscular pyloric portion, which drains the stomach and relieves the mechanical portion of function.

Surgically speaking, the small intestine can be said to begin at the opening of the common duct. The 4 inches of duodenum lying between this point and the pylorus may be called the "vestibule," and this is so closely related to the stomach that a consideration of gastric ulcer necessarily includes duodenal ulcer.

Ulcers of the stomach may be divided into two groups—*acute* and *chronic calloused.*

Acute ulcer does not always show on the outer wall of the stomach, and the diagnosis may be clinical. Well-marked symptoms, including hemorrhages, may exist, and yet a prolonged search of the gastric interior might be necessary in order to detect the lesion. Patients have bled to death from an ulcer so minute as to be discernible only with a lens at postmortem. Ulcers of this description are sometimes merely superficial erosions of small extent, though occasionally they are of enormous size and exhibit fatal characteristics, as pointed out by Dieulafoy. More often a small fissure will be found, or the typical round or oval peptic ulcer. These acute ulcers are usually the result of some gastric toxic substances originating in changed metabolism, *i. e.*, anemia, cirrhosis of the liver, etc.

Chronic calloused ulcers invade all of the coats, and are therefore easily diagnosed from the exterior as typical scar-like masses of irregular size. They are frequently found in the pyloric half of the lesser curvature of the stomach. In this situation ulcer often takes a saddle shape, riding the lesser curvature and extending flap-like down the anterior and posterior wall. When in the region of the pylorus, it is the most common cause of benign pyloric obstruction. Strange to say, the frequency of calloused ulcer in the first 2½ inches of the duodenum has only recently been pointed out, and this is the result of surgical observation rather than of postmortem findings.

It is true that calloused ulcers of the duodenum are more common than in the whole of the stomach, and that nearly four-fifths of these ulcers are found in adult males. This sex characteristic is also true of the calloused gastric ulcer, although not to the same extent, only about two-thirds occurring in males. The calloused ulcer, because of its non-curability medically, is often found at the operating table.

The calloused condition of the indurated ulcer shows its chronicity, and nearly all ulcers of this group are surgical. The acute ulcer, on the contrary, becomes surgical only in certain emergencies, such as perforation and hemorrhage.

Hemorrhage may be so copious and repeated at such frequent intervals as to necessitate an emergency operation. Rodman has pointed out that a single large hemorrhage does not necessitate intervention, while a succession of hemorrhages or chronic bleeding of small amounts, would indicate interference. For acute grave hemorrhages the only safe plan is to open the stomach; find the bleeding point, and either ligate it from the mucus side or excise it (Andrews). In either case the peritoneal coat should be sutured over its base to prevent perforation. Gastrojejunostomy is the operation to be preferred in the chronic and less grave forms of hemorrhage; but it should be borne in mind that a single hemorrhage which is not preceded and followed by the usual signs and symptoms of ulcer is seldom due to ulcer, but usually to some toxic cause.

There are three varieties of perforations—acute, subacute with abscess formation, and chronic.

In 90 per cent. of cases, as pointed out by Brunner, acute perforations occur through some point in the area of a chronic indurated ulcer, and in the large majority of instances there had been previous symptoms of the lesion which were diagnostic.

The treatment for this condition should be immediate operation. The patient who has suffered from symptoms of gastric or duodenal ulcer and is suddenly seized with violent pain, abdominal rigidity, and other symptoms of rupture of a viscus, should be explored at once, as few cases will be saved after a delay of ten hours. If the pain and local tenderness are on the left side, the perforation is probably gastric; if on the right side, duodenal. The latter group is frequently confused with perforating appendicitis. On opening the abdomen the escape of thin fluid and gas points to the nature of the lesion. The perforation should be closed by sutures placed transversely, if possible, so as not to entail future contraction. A drainage opening into the abdominal cavity immediately above the symphysis pubis should be made and a glass drainage-tube introduced into the pelvis. In very early cases the abdomen should be flushed out with quantities of hot saline solution. This is not so necessary in delayed conditions, and if nature has begun to throw out adhesive protections, it is contraindicated. In either case the patient is put in the semi-sitting posture (exaggerated Fowler position) after the upper wound is closed. This method of treatment (semi-sitting posture and pelvic drainage) will save a large number of patients.

Subacute perforations with formations of localized collections of pus are not infrequent. When they occur in the stomach, subdiaphragmatic abscesses are the common result. These accumulations may perforate the diaphragm and appear as empyema.

A very large number of cases have been reported in which operation either just below the diaphragm, or more frequently transpleural, has been followed by recovery. We have had a number of this variety.

Perforation of the duodenum with formation of localized abscess has a tendency to work to the surface of the body, usually in the region of the gall-bladder, and is amenable to incision and drainage. Care should be exercised in opening such an abscess not to break down the limiting wall. The perforation will take care of itself, and if necessary later to overcome obstruction, gastrojejunostomy can be done.

Chronic perforations are exceedingly prone to become adherent to the liver, the transverse mesocolon, the gall-bladder, and the abdominal wall. Slight leakage accounts for the recurrent attacks of regional peritonitis which are so characteristic of indurated ulcer. Adhesions and thickened areas can sometimes be mapped out from the surface, or they may be located with great exactness by the patient. Gastrojejunostomy is the operation of choice for this group of cases, and also for the vast majority of pyloric obstructions, which are the result of cicatricial contraction.

Hour-glass constriction, the result of chronic ulcer, is sometimes present, usually having its base on the lesser curvature. More than one such constriction may exist, so that the stomach is bifid or trifid. There are three methods of operative procedure for hour-glass stomach: First, gastrogastrostomy, or union of the two halves of the stomach around the obstruction (Watson). Second, gastrojejunostomy on the proximal pouch. Inefficient drainage of the distal end sometimes interferes with the completeness of cure in these cases. Third, in a number of cases we have practised complete resection of the hour-glass contraction, with end-to-end circular union. The results have been excellent.

Chronic gastric and duodenal ulcers are to be considered surgically when medicinal treatment has failed to cure, not only in the group of obstructive cases, but in that much larger group where the patients are anemic from chronic blood-loss, and are continuously underfed because of the pain which comes with a proper variety and amount of food. These patients travel from one physician to another, and any temporary improvement gives rise to an erroneous belief on the part of the medical adviser that the patient is cured. It is the old story of appendicitis and gall-stone disease, over again; recovery from each attack is considered a medical cure. Munro asks: "Is it any wonder that the victim of chronic peptic ulcer is spontaneously seeking surgical aid?"

Generally speaking, posterior gastrojejunostomy, uniting the jejunum within 3 or 4 inches of its origin to the posterior wall of the stomach near the greater curvature, has the widest field of usefulness in gastric ulcer, especially if there be interference with drainage. In selected cases of narrow strictures, the Finney gastroduodenostomy is the operation of choice. It has the great advantage of leaving the opening in its normal situation.

Excision of gastric ulcer, especially if it is along the lesser curvature and not giving rise to mechanical symptoms or otherwise interfering with drainage, is an operation of considerable usefulness, and, on account of cancer liability, should always be done if possible. It is probable that complete resection of the ulcer-bearing pyloric end of the stomach and independent gastrojejunostomy, as suggested by Rodman, should be done with more perfection.

Gastrojejunostomy is the operation to be preferred for duodenal ulcer which has but little liability of undergoing malignant change. When possible, the ulcer should be enfolded by a few mattress sutures of linen.

DILATATION OF THE STOMACH

There are two varieties of dilatation of the stomach—acute and chronic. Acute dilatation (in the form which has been recognized) is a rare condition. After some toxic or traumatic cause the stomach suddenly dilates until its cavity may contain a gallon or more of thin dark fluid and a large quantity of gases under great tension. Robson has written most interestingly on this subject. In a few cases gastrojejunostomy has been performed with benefit after lavage had failed. Milder and unrecognized forms of acute dilatation are not uncommon after operations, especially operations on the bile-duct, duodenum, and pylorus. Vomiting as the result of the anesthesia may continue until the vomitus becomes dark brown or greenish-black; and if this is unchecked, the patient may die of acute fatty degeneration of the liver. If properly treated with gastric lavage, the majority will recover.

Chronic dilatation is a symptom, first, of insufficient power; second, of obstruction. First: chronic dilatation due to muscular insufficiency, the so-called "atonic dilatation," is a medical condition. A number of these patients have been subjected to gastrojejunostomy, usually with poor results. Bircher has reduced the size of the dilated stomach by a series of longitudinal plaits of the anterior wall, throwing a ridge into the gastric cavity. The writer has had but little experience with this method, but favorable results have been reported by Weir and others. Second: A variety of gastric dilatation depending upon benign pyloric obstructions, which, as has already been pointed out, are usually the result of ulcer. In the severer forms of this condition gastrojejunostomy is a necessary procedure and gives splendid results.

Valve formation owing to a sharp bend caused by a short gastrohepatic omentum sometimes takes place at the pylorus. If care is exercised in diet in these cases, there are few symptoms; but excess of eating causes a sagging of the stomach, and instead of passing to the right, the pylorus is held taut, causing a sharp flexure or valve. These patients have occasional attacks of vomiting large quantities of ingesta without apparent cause. We have met with a small number of individuals suffering with this intermittent form of obstruction of sufficient severity to demand operation. The Finney gastroduodenostomy is the logical means of giving relief.

ADHESIONS

Adhesions sometimes give rise to distressing symptoms. They are usually the result of chronic gastric perforation, and conservative in nature. The division of such adhesions will not often give permanent relief; reformation is the rule, and this separation may be distinctly harmful in permitting leakage at the ulcer site. Adhesions secondary to disease of the gall-bladder and bile-tract are not at all infrequent. On three occasions we have seen acute pyloric obstruction the result of fistula formation between the gall-bladder and the stomach, stones being found in transit. This condition occurs most frequently between the gall-bladder and the first portion of the duodenum, and not rarely between the common duct and the duodenum. Fortunately in this situation there is much less liability to mechanical interference with the progress of food than there is when the stomach is involved. Adhesions between the bile-tract and the digestive canal are especially prone to occur. In the majority of instances it is best to remove the gall-bladder, if it is involved, after carefully clearing the duct of stones. The entire area is then covered with gastrohepatic omentum, assisted by a transposition of the colon. Andrews recommends that after separating these adhesions the transverse colon should be interposed between the stomach and duodenum, and the edge of the liver, and held in position by a few sutures.

PROLAPSE OF THE STOMACH

Prolapse of the stomach is usually a part of a general enteroptosis. Individuals thus afflicted, as a rule, have general relaxation of all the abdominal visceral supports. The transverse colon will sometimes be found prolapsed, and in a small percentage of cases the liver will be movable. The writer considers prolapse of the stomach as merely one phase of splanchnoptosis rather than as an entity, and he would not often expect operation to give relief. The experience of the medical profession with nephropexy for movable kidney has not been particularly gratifying, and the procedure is decidedly less popular than formerly as a cure for the neurasthenic. It is quite certain that indiscriminate operations for prolapse of the stomach, with or without atonic dilatations and allied neurasthenic conditions, are more apt to be harmful than beneficial. Under such circumstances, gastrojejunostomy in particular is meddlesome surgery, because the prolapsed stomach is not accompanied by stagnation of food and gastric drainage is normal or nearly so.

Three operations have been proposed for the relief of gastroptosis: First, the method of Beyea, which consists in shortening the gastrohepatic omentum by a series of sutures. In the majority of cases of this description the gastrohepatic ligament is so tenuous as to be practically worthless for the purpose. Some favorable results have been recorded. Second, the Coffey method, which consists in suturing the omentum immediately below the greater curvature of the stomach to the abdominal wall transversely just above the umbilicus. While I am not impressed with the operation, as it seems to me that such wholesale formation of adhesions carries with it certain disadvantages, still Coffey's favorable experience with it, and his earned reputation as a careful, conscientious surgeon, entitle it to consideration. Third, in a few cases in which prolapse of the stomach has been associated with valve formation and resultant dilatation we have united the lesser curvature about 2 inches distant from the pylorus to the lower border of the suspensory ligament of the liver by firm mattress sutures of linen or silk. This has the advantage of not fixing the stomach, on account of the movable character of its support. Mechanically it seems to answer the purpose.

DISEASES OF THE INTESTINE

By William A. Edwards, M.D.

Neuroses of the Intestines

Nervous diseases of the intestines are a series of curious phenomena that occur without demonstrable lesions, but are rather considered to be due to functional alterations in the nerve-supply. The motor, sensory, or secretory intestinal nerves may thus be at fault, although histologic alterations in their structures have not, and probably cannot, be demonstrated. As Gray correctly says: "The pathologic alterations are either cellular or vascular in so slight a degree that their exact nature has not yet been determined by the aids to investigation which are at our disposal in our present state of knowledge."

These diseases are arbitrarily classified under three general heads, as (1) motor, (2) sensory, and (3) secretory neuroses, and will be so considered in this section. This classification, while not exact, is still useful for purposes of study, and is based upon the most predominant symptoms of these functional intestinal diseases.

For the purposes of study we shall consider the following diseases under the head of "Neuroses of the Intestines":

1. *Motor Neuroses.*—Peristaltic Unrest, Nervous Diarrhea, Enterospasm, Intestinal Paralysis.

2. *Sensory Neuroses.*—Intestinal Neuralgia, Intestinal Anesthesia, Intestinal Paresthesia.

3. *Secretory Neuroses.*—Mucous Colitis or Colic (Membranous Enteritis).

The anatomic structure of the intestines renders them favorable sites for neuroses on account of increased irritability of the nerves which are in direct or very intimate connection with the spinal and cerebral system and also with the nerve-supply of contiguous organs.

The study of these diseases is rendered doubly hard because our knowledge of the anatomy and the physiology of the intestinal tract is not as full as we would wish it. In order to classify the diseases as intestinal neuroses we must, of course, exclude all demonstrable pathologic or anatomic alterations—a matter sometimes very difficult of accomplishment. The text-books and the journal literature are peculiarly deficient in the consideration of intestinal neuroses, and only within a few years have the investigations and writings of Mall, Hemmeter, Nothnagel, Houkgeest, Einhorn, Boas, Leube and others thrown any light upon the subject. The Germans have been the most active, and most of the literature is found in German-speaking periodicals. These writings seem to show conclusively that the intestines have both sensory and secretory nerves, and that they are probably reflexly excited by the gastric nerves. Indeed, the relation between the neuroses of the stomach and those of the intestines is most intimate; in many instances they are combined.

MOTOR NEUROSES

Peristaltic Unrest

Peristaltic unrest is usually seen in nervous hysterical women or those who are hypochondriacal. It is a marked increase of the normal intestinal movements due either to increased excitability of the motor or sensory nerves of the intestines or to systemic toxic irritants from the blood-stream, or, again, to local irritants acting directly on the intestinal mucosa.

We must not confound peristaltic unrest with the increased peristalsis that is seen in intestinal occlusion, chronic stenosis, catarrhs, and diarrheas; in these conditions, where, in addition to the anatomic alterations, there are decomposition and fermentation of food, the peristaltic action may be excessive. It is increased peristalsis without any objective anatomic changes that is called peristaltic unrest. This will be accompanied by subjective sensations, contractions and uneasiness of the intestines, cramp-like pains, sometimes borborygmus, rumblings, gurgling, and swashing. These latter may be loud enough to annoy the patient and be heard by other persons close by. If the motor nerves alone are involved, all the concomitant complaints are less marked. In these patients the intestinal noises and the retained stools are about their only complaint. Some of these patients are kept from sleep by the extreme activity of the peristalsis and the noises and the gurglings; a similar condition in the stomach often adds to the discomfort.

It must not be forgotten that peristaltic unrest may occur in persons who are apparently perfectly healthy and in those who give no evidence at all of the neurasthenic state. In these apparently healthy people it often arises at pregnancy or menstruation; in others it arises after the ingestion of highly seasoned or indigestible food. Hemmeter thinks that the excessive use of tobacco will produce it; mental excitement and tight lacing have also been ascribed as causes. A large proportion of the cases will arise without any known cause.

Curiously enough, the increased peristaltic action does not produce a frequent, thin, watery stool, but rather a condition of retained stools. This is due to the sluggish action of the large intestine in comparison with the great activity of the smaller gut. The German writers rather think that this form of constipation or stool retention is due to antiperistaltic movement in the large intestine, and that when the two movements conflict, fecal accumulation occurs. J. C. Hemmeter,* in an interesting contribution to intestinal antiperistalsis, seems to have demonstrated a movement of small particles in man from the rectum to the stomach. The movement occurs along the walls, and while the upward movement is active, there is also a central downward movement of fecal masses. The antiperistalsis, however, cannot move ingesta in large masses. The strong visible antiperistaltic movements of Nothnagel occur only under abnormal conditions. Kaplan* has described a condition which he styles nervous pseudotympany, or accordion abdomen. There is either a general or a partial distention of the abdomen, limited to one or more regions, which collapses under narcosis without the escape of gas, through either the mouth or the anus. It reappears as the narcosis passes off. It may appear very rapidly and disappear just as rapidly. The patients are usually hysterics, and of eighteen cases sixteen were women. The distention may be so pronounced as to produce asphyxia. Anatomic alterations are not demonstrable.

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* Arch. f. Verdauungs-Krank., Bd. viii, Hefte 1 u. 2.

The most exaggerated form of peristaltic unrest is that in which the waves take opposite directions, that is, one wave upward toward the stomach and the other downward toward the rectum; this results in stercoraceous vomiting.

The general diagnosis of peristaltic unrest can usually be made with great ease and with a fair amount of accuracy. The other nervous symptoms which are present aid us very much in determining the existence of neurosis. The case which has an anatomic basis can easily be excluded from those which are purely neurotic. The prognosis is never grave and is apt to be quite favorable except in those cases in which there are demonstrable changes in the nerves, particularly the splanchnics.

Treatment.—The milder forms of this disease will hardly come under medical care. The more severe types will receive benefit from regulation of the diet by supplying non-irritating foods, mild purgatives, and rest. Small doses of heroin ($\frac{1}{12}$ to $\frac{1}{24}$ gr.) or codein ($\frac{1}{8}$ to $\frac{1}{12}$ gr.) will relieve the cramp pains and general unrest. Belladonna in the form of tincture (4- to 10-drop doses) will often prove efficacious. Morphin is not advised on account of its constipating effect and danger of habit induction. Potassium bromid has been a valuable drug in our hands for the general comfort of these cases and to quiet the intestinal storms sufficiently to allow the patient restful sleep.

Many patients will need a general treatment appropriate to those who are neurasthenic and hysterical. If the patient presents evidence of distinct constitutional disease, as gout, rheumatic or uric acid diathesis, these too must receive appropriate treatment. The marked gastric acidity or hyperchlorhydria which often coexists will be relieved by the alkaline carbonates, as carbonate of soda or calcined magnesia.

Hemmeter strongly recommends the following for obstinate cases of peristaltic unrest:

℞.	Tincturæ valerianæ ammoniatæ	ʒ x
	Strontii bromidi	ʒ iv
	Liquoris potassii arsenitis	gtt. l
	Extracti opii denar	gr. ij
	Elixiris simplicis	q.s. ℥ vj

M. Sig.—One tablespoonful three or four times a day.

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* Gaz. Hebd. de med. et de Chir., 1901, No. 70.

The following has proved of value in my hands:

℞. Ichthoform (Merck)	gr. xij
Salol	gr. xxiv
Bismuth subnitrite	gr. xxxvj
Heroin hydrochlorate	gr. $\frac{3}{4}$

M. et div. in cap. No. xii.
S.—One an hour before meals and at bedtime.

Sometimes $\frac{1}{12}$ gr. of hydrargyri chloridum mite is added to each capsule with advantage; if so, the dose of heroin is also made $\frac{1}{12}$ grain.

NERVOUS DIARRHEA

If we accept the definition of diarrhea as an abnormal frequency of the evacuation of the feces, thin in consistency, and connected with tenesmus, the existence then of a nervous diarrhea must be determined by a process of exclusion, and even then it may be difficult to distinguish it from the stercoral form, as here the gases CO_2, CH_2, and H_2S, produced during the habitual constipation, may bring on an exaggerated peristalsis; in the beginning this stercoral diarrhea is not associated with enteritis.

Nervous diarrhea has four prominent etiologic factors: either irritation of the nerves that excite peristalsis or paralysis of those nerves which inhibit it; irritation or excitation of the peripheral nerves in the wall of the gut itself, and increased serous exudate—a sort of angioneurotic edema. Nervous diarrhea is most usually seen in association with other nervous phenomena, and it may be either acute or chronic in its manifestations. The former is illustrated by those diarrheas which follow intense fear or sudden fright; the latter are seen in nervous men and women who complain at the same time of heat and cold in various parts of the body, feelings of fear and oppression, accelerated breathing, cardiac palpitation, giddiness and vertigo, and other so-called nervous symptoms.

The diarrhea in these nervous, hysterical, or hypochondriacal subjects is often accompanied by neuralgia and functional disorders of the genito-urinary organs. The number of stools varies from one or two to ten or twenty-five in twenty-four hours. The stools consist of liquid intestinal contents, but usually contain very little mucus. This is a good diagnostic point, that is, the absence of abnormal constituents in the stool and the presence of marked nervous symptoms. It may, however, like persistaltic unrest, occur in those who are decidedly not nervous, hysterical, or neurasthenic. The treatment of nervous diarrhea is essentially that of the underlying causal factor—neurasthenia. This embraces the well-known methods that will be considered elsewhere in this treatise. The diet must be not only that which is appropriate to that condition, but must also be of such nature as not to further provoke the intestines in their perverted nerve control. Milk is here to be the main article of diet. Eggs, toast, and scraped meats may also be used. Claret or Burgundy may be used with caution and may prove very efficacious.

Opium, calomel, castor oil, and sulphate of magnesia are practically the only drugs worth considering in treating a case of this form of diarrhea. Later in the case, when the more exacting symptoms have been somewhat controlled, then tannigen, salol, or bismuth, still combined with some opium derivative, as codein, heroin, or dionin, will produce the best results.

Angioneurotic Edema of the Intestine

Acute local, acute circumscribed, or angioneurotic edema, a disease characterized by the sudden onset in various regions of edematous swellings, more or less limited in extent and of transient duration, has been described in medical literature for some time, more particularly by Barlow, Quincke, Lucke, Osler, Jamieson, Graham, W. A. Edwards, and others. Only recently, however, has this disease been observed in the intestinal tract, when it produces symptoms which are extremely difficult of interpretation. We agree with Cohnheim that we have to do here with clinical facts and observations which urgently call for scientific investigation, and that we possess but extremely scanty material for an adequate explanation of neurotic edema. I will cite one example from the literature to make the matter more clear. Harrington* had charge of a young single woman, aged twenty-six, whose initial symptoms strongly suggested gall-stones. For many years this woman had attacks of swelling of the hands; during the last few years they occurred every few weeks, and involved also the hands and the elbows. The face and trunk were also sometimes involved. Finally attacks of abdominal colic appeared, and one of these attacks was so severe that laparotomy was performed. An interesting condition was revealed. At a point within a short distance of the ileocecal valve a cylindric involvement of the ileum 2½ inches long was seen, which entirely surrounded the gut, increasing the bowel circumference to twice its normal size. The swelling was in the bowel wall, elastic to touch. There was no distention above or below the lesion, which was an angioneurotic edema of the bowel wall. Nothing, of course, was done to the bowel; the incision was simply closed up and she had a smooth convalescence.

Gastro-intestinal disturbances, severe colic, pain and nausea, and sometimes vomiting are usual concomitants of all attacks of angioneurotic edema, no matter what part of the body is attacked, but the direct demonstration of Harrington's case is most instructive and interesting. The treatment is absolutely unsatisfactory. There is little to do and the disease usually resists all our efforts at amelioration. The associated conditions of nervousness or anemia may, of course, receive appropriate treatment. Osler thinks that improvement may follow the use of large doses of strychnin and the prolonged use of nitroglycerin. Neither of these drugs has produced any appreciable permanent effect in my hands.

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* Boston Med. and Surg. Jour., March 30, 1905.

ENTEROSPASM

Ehrman's studies seem to show that the longitudinal muscular layer of the intestine is innervated by excito-motor fibers of the splanchnic nerve, and by inhibitory fibers in the vagus. The circular muscle is in turn innervated by excito-motor fibers in the vagus and by inhibitory fibers of the splanchnics. When simultaneous tonic contraction of the longitudinal and the circular muscle of the intestine occurs, the condition known as enterospasm exists.

Normally these contractions alternate one with the other, and thus peristalsis—normal peristalsis—is maintained. It is their simultaneous action that produces the disease under consideration. The disease must be due either to an increase in the irritability of fibers of both vagus and splanchnic which cause the intestinal muscularis to contract, or contrariwise, to decreased function of both sets of inhibitory nerves.

The motor impulses are always stronger than the inhibitory. Hence we see that the differentiation of enterospasm from colic is a difficult matter, and can be done with certainty only when pain is absent, and it is not often absent.

The enterospasm may involve the entire intestinal tract or single and isolated segments may be attacked; the latter is the usual manifestation. There is always stool retention in either form of the disease, and the fecal mass shows the same changes that are observed in stenosis and inanition.

Proctospasm may complicate enterospasm. It must be remembered that enterospasm is a diseased condition about which little that is definite and positive is known. Indeed, an authority as reliable as Nothnagel thinks that enterospasm is not sufficiently distinct from hysteria, hypochondria, or neurasthenia to merit separate classification. Hemmeter, on the other hand, has this to say: "While primary spastic conditions of the muscularis are indeed very rare, there is no doubt in my mind that they do occur; at least, I have had an opportunity to observe three cases on different occasions, which after most critical study I could not consider in any other light than that of functional enterospasm."

In one of the writer's cases the enterospasm seemed to be due to hyperchlorhydria, as a relief of that condition cured the enterospasm. In another case a pyloroplastic operation, after the method of Heincke and Mikulicz, relieved the enterospasm somewhat, but the patient occasionally has attacks still. At the operation nothing whatever abnormal could be detected in the abdomen or pelvis.

We do know that the more usual form of enterospasm, that which is confined to single sections of the large intestine, is generally seen in nervous, irritable women who are the subjects of hysteria and neurasthenia, and particularly in those who, in addition, have uterine disorders; this combination is its selective habitat. Given this combination, an irritant of the intestine may set up an enterospasm; it follows irritant foods or drastic purges.

In men it is also seen among those who are neurotic and among artisans who suffer from chronic lead-poisoning. Hemmeter adds as another cause the first stage of basal meningitis and other diseases of the central nervous system where pressure is exerted on the pons and medulla oblongata. Some of the cases in both men and women are seen as either concomitants or sequels of colitis. The latter may be either the cause or the effect. We hardly have to do, in this section, with the enterospasm that is seen to accompany basilar meningitis or other diseases of the central nervous system, in which the boat-shaped abdomen is seen, but rather with that form in which a smaller section of the gut is involved and the trough-like abdomen is not seen.

The spasm may be so intense as almost completely to obliterate the lumen of the intestine, and the gut-wall above the spasm may become greatly distended with gas and feces. The alternating contractions of the circular and longitudinal muscularis have ceased and marked stool retention is the result; this is the so-called spastic constipation. The suprastenotic loops may contain great masses of feces for days, and if proctospasm coexists evacuations do not occur. The stools are flattened bands or small rat-tail cylinders, or they may resemble sheep dung. When retained a long time, they are dark brown in color.

Pain almost always accompanies enterospasm, but it is not of special aid in diagnosis. Its seat is variable and may be widely distributed over the entire abdomen. It is usually relieved by copious fecal evacuations, but soon returns.

The diagnosis of the circumscribed form, the only form that we shall consider, is often very difficult. The history will help us, and if we pay due regard to the nervous and hysterical elements of the case, the diagnosis can usually be made.

Strouss's case* closely simulated stenosis of the intestine; twice it so closely resembled intestinal obstruction that celiotomy was done, but no stenosis was found. Later the patient, a man aged twenty-nine, had an evident hysteric attack with anesthesia, aphasia, abasia, and other hysterical symptoms; the meteorism and enterospasm entirely disappeared during this hysteric storm.

While the disease is obstinate and troublesome, its prognosis is as good as the general underlying causative condition—either hysteria or neurasthenia.

Diagnosis.—The cecum and sigmoid are the chief sites of spastic contractions. The spasmodic contraction of the intestinal muscularis occurs at intervals. The duration is variable; an attack may last a few weeks or but a few hours, but with frequent or more or less protracted interruptions. The intestines are atonic. It would seem that atony is the base from which the spasm develops. In neurasthenia the development of a spasm of the automatic musculature from an atonic intestine is seen very frequently.

Many of these patients feel these spasmodic contractions of the intestines as an oppressive or unpleasant sensation in the abdomen;

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* Berlin. klin. Woch., Sept. 19, 1898.

this sometimes increases to a colic. The spastic contractions of the musculature are by some felt as low down as the rectum or anus. In some of these patients contracted intestinal knots, especially in the right and left portions of the lower abdomen, are palpable and visible.

Sometimes we are able, either continuously or temporarily, to feel sausage-shaped enlargements about the size of one's finger, which are easily moved to and fro, of elastic consistency, and often exquisitely sensitive to pressure. If this syndrome is confined to the cecal region, which is often the case, it may give rise to confusion with other sensations of resistance in this region, and give us some trouble to differentiate between this spastic condition and chronic subacute appendicitis. Unless great care is exercised a prognosis which is altogether too grave may be given. Rectal exploration affords great aid in just these cases, as the spasm is also apt to involve the sphincters, and the finger may be convulsively grasped by the spastic sphincters; indeed, in some cases the spastic condition may be limited to this inferior segment of the intestinal tract.

Treatment.—Here, as in the other neuroses of the intestine, the general nervous system must receive careful attention. But the patient will demand immediate relief from pain, and probably it will be necessary to commence by giving morphin, or at least some opium derivative. If the relief thus afforded does not cause, or better allow, a fecal movement, we should endeavor to secure an evacuation by some mild laxative or purgative. Of these, perhaps the best is castor oil or an oil enema, which often is most efficacious. Active purgation is distinctly contraindicated, as are massage and perhaps electricity—certainly not the faradic current. The galvanic current, mild, may do some good; perhaps not. Hemmeter recommends Priessnitz bandages at night; they will do some good to many patients. Most of these people will find comfort in hot applications to the entire abdomen.

Accepting as we do the statements of Westphalia, of St. Petersburg, and Senger, of Vienna, that the spasm develops from atony of the muscularis, then we must refrain from all that will excite this atonic condition and spastic contractions with pain. Our efforts must be directed to an amelioration or improvement of the irritating condition and to calming the excited nerves.

The warm bath, either sitz or general, at a temperature of 100° F. to 112° F., and maintained for fifteen to twenty minutes, is a valuable procedure. Hot abdominal compresses will ease pain and relieve the spasm. The patient may be allowed to decide whether these are to be dry or moist. Warm enemas of olive or raw linseed oil, given in the knee-chest position, are often most grateful and efficacious, particularly if there is prolonged retention of the oil.

Atropin or belladonna will prove to be the best antispasmodic; the latter may be used in suppository with advantage—doses of 1 to 1½ grains of the extract of belladonna two or three times a day. It distinctly diminishes any tendency to spasm of the muscular coats.

The diet, in our experience, should be as bland as possible, although some good authorities advise coarse foods. It is hardly necessary to add that simple and easily digested food should alone be allowed these patients. The food which irritates the least will be the best. We can allow these patients the free use of milk, all sorts of wheaten bread made from fine flour, greens without husks or shells, and cooked fruits, soups and broths, and tender meats. The foods which are especially to be denied are coffee, spices or pepper, mustard, acids, vinegar or acid foods in general, alcohol, pastry, cakes, cabbage, cucumbers, celery, radishes, cheese, and carbonated drinks, as beer, vichy, seltzer, or soda water.

Above all, these patients should not rest in bed, as in this way the primary causal atrophy is increased. Exercise in the fresh air is essential to render our curative efforts at all certain. In those who are intensely neurasthenic or hysterical the fattening cure is alone indicated.

The value of Massage, as applied to enterospasm, colic, and enteralgia, is still a moot question. We ourselves feel that it has a place in the therapeusis of these conditions. The main cause of atony and dilatation is the fatigue toxin. During the period of rest antitoxins are generated by the fatigue toxins, which neutralize the action of the former. As the toxins of fatigue are not dialyzable, but remain where formed, massage or gentle rubbing will hasten the union of the antitoxin with the toxin, and recovery from fatigue will result. The abdominal circulation plays an important part in atony of the intestine, as venous blood aids fatigue. Here again massage has a place.

INTESTINAL PARALYSIS

Intestinal paralysis will be more fully considered in the section on "Intestinal Obstruction and Occlusion," but it also finds a place under "Intestinal Neuroses," and we shall so consider it.

Of course, the most frequent and most usual cause for intestinal paralysis is peritonitis, which may be either general or circumscribed. It is then due to serum infiltration of the muscular layer of the gut; but the paresis may occur in a peritoneal infection without exudation, as shown by Ohlshausen and Riechel. The latter regards the pathology as a toxemia of the muscular layer or of its nervous apparatus by the products of bacteria. Intestinal paralysis is really a symptom or a resultant of conditions, and these conditions may be disease either of the intestine itself or of the other organs within the abdominal cavity; for example, it is seen in all forms of stenosis, occlusion, or obstruction of the bowels, in enteritis with ulceration, tuberculosis, typhoid fever, and, as already said, in peritonitis. It occurs also in those abdomens that have been subjected to extensive surgical manipulations and handling of the internal serosa without peritonitis or infection; this seems to be a pure nervous inhibition. In the so-called secondary paralysis of the intestines—that is, those cases in which the paralysis follows one or other of the conditions already mentioned—its etiology is usually first an increased and tumultuous peristalsis, which is followed by exhaustion and paralysis of the muscularis. If this lasts for a long time, the paresis is permanent, and hyperdistention may become so marked and the accumulation of feces so enormous that the intestinal lumen becomes obliterated by condensed fecal masses; a condition styled coprostatic obstruction then exists. The acute surgical paralysis of the intestine has a different clinical picture; it usually sets in suddenly without primary increase in peristalsis, and is seen in general peritonitis and injuries of the gut-wall itself, as hernial protrusions and abdominal operations.

Besides the diseases confined to the abdominal segments of the body, paralyses of the intestine are seen in spinal and cerebral diseases, as meningitis, myelitis, tabes, cerebral tumor growths, and in hypochondriacs, hysterics, and melancholics.

Long-continued intestinal paralysis offers but little hope that the muscularis will regain its function. In some of these cases in which we are able to remove the cause and to rid the intestine of decomposed feces and gases the intestinal muscularis will regain a fair amount of tone; this may be true even if the lumen is diseased at a single point.

Treatment.—As in all secondary diseases, the underlying disease must first claim our attention. If this permits of successful treatment, the paralyses will be readily relieved by electricity and massage. The intestinal tract should be swept clean by copious enemas and maintained in a cleanly state, but drastic purges are absolutely contraindicated. Strychnin in combination with aloin and belladonna is a valued combination. Cascara sagrada will prove of great value after the intestinal canal has been cleared of accumulated fecal masses. It should be administered over a long space of time. It may be used as the fluidextract of cascara sagrada, aromatized (assayed), or cascara cordial or cascara evacuant—all made by prominent firms in the United States and all about equally reliable.

Paralysis of the sphincters hardly comes within the scope of this article, as it is always a secondary disease, and is seen after long-continued rectal diseases, when at first spastic contraction of the sphincters is maintained long enough to lead to fatigue and ultimate complete paralysis of the muscularis. In diseases of the brain and spinal cord the paralysis is of purely nervous origin and occurs without anatomic alteration in the intestine, and here alone can it be classed as a neurosis. If it is due to an incurable disease, the prognosis is, of course, unfavorable; but if due to a neurotic state or exhaustion, it may be relieved or cured by appropriate treatment.

Treatment.—Again must the cause be removed, if possible. The intestine must be kept free from fecal accumulations, preferably by enemas. The rectum must not be allowed to become a fecal reservoir. If constant urination with severe straining exists, the catheter must be used frequently. Electricity, massage, and the hypodermatic use of strychnin are about the only therapeutic measures which offer hope of relief.

Enemas of cold water or astringents, tannin, quassia, oak bark, or sulphate of iron, may do good in some cases. In other cases the actual cautery may be applied, four to six narrow lines being made in the long axis of the gut from the skin margin along the mucosa from 1 to 1½ inches.

A method that has been useful in our hands is to excise wedge-shaped strips from the margin of the anus, including a little mucous membrane. The face of the wedge is at the anus. The edges of the wound, when brought together and allowed to contract, will support the sphincters and assist in retaining bowel contents.

SENSORY NEUROSES

Under this term is comprised the states known as *intestinal neuralgia*, *intestinal anesthesia*, and *intestinal paresthesia*. Only the first has any clinical interest.

They are all due to either an increase or a decrease of the normal excitability of the sensory intestinal nerves. Those under the first heading—an increase in the normal excitability—are frequently seen in the familiar manifestation of colic or enteralgia and in the somewhat more unusual form of hypogastric neuralgia. Practically the only clinical manifestation of anesthesia of the intestine that can be demonstrated is that in which the sensory rectal nerves are anesthetic from either spinal cord disease or long-continued fecal accumulations in the rectum; this, carried to its final degree, also involves the rectal sphincters, both internal and external.

If we confine ourselves, as heretofore in this section, to a consideration of only the purely neurotic examples of the disease, we must again agree with Nothnagel that colic cannot be included in a study of sensory neuroses of the intestine, as it is a secondary condition caused by tetanic intestinal contractions. It is a demonstration of exaggerated excitability of sensory intestinal nerves. The same authority describes two forms: neuralgia nervi splanchnici and neuralgia plexus mesenterici.

Intestinal Neuralgia

Intestinal neuralgia may be caused by pressure, by irritation or functional disturbances of the nerves or their centers, or it may accompany a general neuritis. Gant has seen it in association with alcoholic neuritis. In women it is also seen in association with other neuralgic symptoms and in those who are anemic.

It may arise from intestinal irritants, which in time may reach the nerves through the lumen of the gut or through the general circulation; hence constipation is always an important etiologic factor for two reasons—first, pressure on the nerves by fecal masses and the gases of decomposition, and, second, the pathogenic micro-organisms which, while they are probably always present, are allowed to become active and irritating from fecal stagnation. This fecal toxemia may be considered of the first importance.

When the neuralgia is low down in the intestinal canal, a displacement of the coccyx and the resultant nerve irritation from pressure is the most common cause. So we see that the number of irritants which may cause enteralgia is very great.

In a large number of cases faulty diet, either in quantity or quality, is the prime cause. Enteralgia has also apparently arisen after the ingestion of large quantities of iced drinks.

Hemmeter thinks that some people, or indeed some families, have an idiosyncrasy toward certain foods whose ingestion will produce an enteralgia. These are fish, oysters, crabs, fruits, and certain vegetables which are neither harmful nor hard to digest, and which agree with most people. This is also seen in purges in different persons. We ourselves rather prefer to consider this under the classification of urticaria, or an angioneurosis of the intestinal tract; the pain here is probably due to vasomotor disturbance with a toxic origin; dilatation follows spasm of the vessels and results in effusion.

The symptomatology of an enteralgia which is a pure neurosis is not typical, because it is usually a symptom of a basal disorder, as neurasthenia, hysteria, or lead-poisoning. Its clinical picture will vary with its causative factors; a faulty diet will give its usual poisoning manifestations, as will also stercoral colic, or chronic lead-poisoning. Its main symptoms will always be pain, increasing in severity from a comparatively mild onset. These pains are usually stabbing, griping, or twisting, and are centered about the umbilicus, radiating toward the back and groin and into the testicles or ovaries.

The pain is of all degrees, and may culminate in excruciating agony, the patient looking shocked, sweating heavily, with anxious expression and cold extremities. Pressure often relieves this pain; hence the well-known doubled up position that these patients so often assume. If there is great gaseous distention, however, pressure may increase the pain.

Spastic contractions of the intestines occur frequently, and are sometimes visible and sometimes audible. If the contractions persist, as in lead-poisoning, the familiar boat-shaped abdomen is seen. The abdomen may be unequally and irregularly distended from gaseous distention and stagnant feces.

The **diagnosis** presents some problems if we endeavor to differentiate a neurosis pure and simple—that is, a primary enteralgia—from a secondary colic, in the sense that Nothnagel uses the term. But with us in this treatise the differential diagnosis is not especially essential, as the treatment is identical.

MUCOUS COLIC

Mucous colic is a manifestation of perverted secretory and absorptive functions of the intestinal mucosa. It is a general disease in which there is an abnormal secretion of mucus from the whole internal surface of the alimentary canal. The fact that many different names and many etiologic factors have been advanced to designate the train of symptoms and explain the pathology of the disease serves to show that as yet there is not an entire consensus of opinion as to the proper classification of this condition. In my writings for the last twenty years I have preferred and used the term mucous disease and membranous enteritis.* As the term "mucous colic" simply uses the principal symptom as a designating title, it adds nothing to our knowledge.

The disease may be considered as a symptom-complex, characterized by recurring attacks of abdominal pain with the discharge of mucous masses, often peculiarly shaped, and sometimes almost a complete cast of the intestine, accompanied by fever and relieved by the passage of these masses or tubes of mucus.

The most varied and opposite etiologic factors have been adduced in endeavoring to arrive at a true understanding of the causative agents in producing the condition variously styled tubular diarrhea or pseudomembranous enteritis, whose synonyms are legion. It is probable that under the influence of obscure causes the toxins secreted by certain bacteria penetrate with the blood and produce the changes in the intestinal canal that manifest themselves in the formation of false membranes. The membranes mainly consist of true mucin; fibrin is not found, but they may contain fat or soapy material.

Most cases occur in young adult females who are hysterical or of a neurotic or nervous disposition. Eighty per cent. of the recorded adult cases are in women. The disease accompanies and sometimes seems to be a part of the diseases of the genital tract or of the intestinal or nervous systems. Most cases give a history of antecedent dyspepsia and constipation alternating with diarrhea in addition to the so-called pelvic symptoms of women. It may follow typhoid fever, enteralgia, hemorrhoids, the infectious diseases, particularly measles and scarlatina, and more particularly pertussis, and the abuse of drugs, notably podophyllin and mercury.

We have thought, and so taught our classes for many years, that the true etiology of the disease is to be found in disorder of the nerves which preside over the nutrition and secretions of the intestines; the ganglionic nerves of the intestines are at fault, but its cause may be sought for in vain.

This view is indorsed by Nothnagel, who also agrees with me that the neurasthenia that accompanies the disease so often is in fact the cause of it, a statement further indorsed by many, notably Harrison, King, Osler, Weigert, and Westphalen. It has been charged that those of us who believe in this pathology get over the difficulty that the disease is sometimes found associated with definite lesions of the colon by putting these cases in another class and calling them secondary colitis, or by some other designation. Now, this is exactly what I have been contending for for more than twenty years, namely, that there is a disease of the colon whose pathology is that of a disease or disorder of the nerves that preside over the nutrition and secretion of the colon, without demonstrable lesions in the colon itself.

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* In order that the reader may not be confused and may understand the disease of which I treat I append a portion of the host of synonyms under which the disease appears in medical writings: Pellicular colitis; intestinal cast; pseudo-membranous enteritis; intestinal desquamative catarrh; mucous disease; chronic muco-colitis; chronic cramps of the intestine; chronic pellicular inflammation of the intestinal mucous membrane; fibrinous diarrhea; follicular, duodenal, or colonic dyspepsia; chronic pseudo-membranous gastro-enteritis; tubular looseness; tubular exudation; casts of the intestine; mucous or gelatinous diarrhea; mucous casts; hypochondriasis pituitosa; chronic exudative enteritis; diarrhea febrilis; paraphexin rheumatica; mucositas intestinalis colloides; mucous disease of the colon.

French: Entérite interstitille; entérite pseudomembraneuse; colique glaireuse; concutiones gelatineformes intestinales; diarrheé glutineuse; entérite glaireuse; herpétide exfoliatrice; colite séche; dysentery du colon transverse; entérite mucino-membraneuse; concretions muqueses membraniformes de l'intestin.

The German writers have also adopted their peculiar nomenclature. Walter, in 1885, wrote upon "Enteritis Membranacea" (Von Leyden, Deutsch. med. Wochenschr., 1882. Bd. xvi); Nothnagel, in 1884, upon "Colica Mucosa," and others have written of the disease under other names.

It is but fair to say that Lockhart Mummery, Van Noorden, Boas, and Tuttle continue to maintain that the condition is always a true colitis with definite lesions in the colon. It has always seemed to me that the confusion that has arisen is due to the fact that both diseases exist, that both are mucous colitis, but that their etiology and pathology are different, one being the result of abnormal nerve-supply, and the other the result of lesions within the colon itself.

More definite knowledge is coming to us from subjecting the cases to surgical relief, when the interior of the colon may be examined *in situ;* aid in the diagnosis has also been given us by the electric sigmoidoscope. As time goes on, with improved methods of diagnosis more of the cases will have a definite lesion in the colon as their pathology, and less will come under the classification of deficient nervous control; perhaps the latter classification will entirely pass away. The disease is so rarely fatal of itself that the opportunity to make a post-mortem examination does not often present itself. In the two that I made some years ago, and which have been extensively quoted in the literature, there were no demonstrable lesions in the colon.

The disease, therefore, seems to divide itself under two headings: First, cases in which the passage of the membrane is accompanied by all the symptoms and concomitants of enteritis or enterocolitis in their acute or chronic forms; and second, cases in which the passage of the membrane is about the most prominent symptom, the other concomitants being absent or but comparatively mildly in evidence—these are the most unusual cases. The passage of the casts is usually paroxysmal, accompanied by abdominal pain, tenesmus, and nervous disturbances, and is preceded or followed by digestive disturbances. Those who are the subjects of mucous colitis often have enteroptosis achylia gastrica. The motor function of the stomach is not apt to be diminished; in some it is excessive, and possibly hyperchlorhydria may be noted. Abdominal tenderness, to a greater or lesser degree, almost always exists, and is generally relieved by the passage of the membranes; blood may be present in the discharges, although this is unusual and rather atypical. At this time the bladder will usually present some symptoms; in fact, almost invariably, should the disease occur in a female where manifestations of uterine disorders are present.

These patients do not lose the normal contour of the body, but present some evidences of malnutrition. They may have from time to time eruptions of furuncles or carbuncles, sore mouth, or herpes of the genitals, and an irritable nervous system. Emaciation is rarely a marked symptom; this almost complete lack of emaciation persists throughout the disease, notwithstanding the amount of matter passed out.

The number of paroxysms and the duration of the attack are variable. Some patients can foretell an attack with remarkable accuracy by certain symptoms which they have learned to know always precede a paroxysm, as chilblains, blueness of the nails, and tingling or pain at the finger-tips. A person the subject of this disease may suffer but one attack in a year, or one a month; or, on the other hand, the paroxysms may be continuous, or nearly so. In the more chronic cases there may be an almost constant sequence of symptoms. We must bear in mind that these patients are usually dyspeptic, and suffer more or less constantly from abdominal distress and constipation. Just before an attack the abdominal distress becomes actual pain, and is usually referred to the region about the umbilicus, or the tenderness may exist over the entire abdomen, or, again, it may be deep-seated and only demonstrated by careful palpation. Membranes are not found in each stool during a paroxysm, as a rule, but a single large accumulation is generally passed, accompanied by pain and tenesmus. Some cases discharge the membrane only about once a week; others may have ten or a dozen membranous stools in twenty-four hours during the paroxysms.

Hemorrhoids, prolapse of the rectum, diarrhea, jaundice, extreme thirst, coated, anemic, and fissured tongue, aphthous ulcer of the mouth, and tonsillar phagedena have all been noted in the symptomatology of the disease, either as direct symptoms or as concomitants.

The nervous system presents many and varied manifestations. The hysterical derangements are the most frequent of all the functional disturbances. This applies to both males and females affected with mucous disease. The following symptoms have been noted : Neuralgia, hyperesthesia, irregular muscular tremors, paresis, hysterical tetanus, coma, and convulsions. Transient defects in vision, tinnitus aurium, and diseased sense of taste are all among the recorded symptoms.

Whitehead notes chorea and paralysis in children (a number of cases of mucous colitis have been recorded in children about the tenth year of life), and Copeland has observed a cataleptic condition following one hysterical outbreak in one who was the subject of mucous disease. Mental depression, faulty memory, hypochondriasis, and melancholia may be exhibited for a time, to be followed in some cases by increased mental activity.

The association of this disease with uterine disorders has already been noted. A simultaneous discharge may take place from the bladder and the bowel. Cystitis, strangury, and frequent micturition may cause loud complaint. The urine presents no specific alterations.

The temperature is normal, except possibly at the height of an attack.

Macroscopic and Microscopic Appearances of the Membranes.—They are for the most part made up of opaque, white, solid masses, rounded or flattened, and small flocculent pieces of semi-translucent membrane. The membranes are delicate, and are handled only with the greatest difficulty out of water. Under a 2-inch objective their surfaces are seen to be composed of opaque and translucent parts, the former apparent as rounded ridges, marking off the latter into regularly arranged hexagonal or polygonal crypts. The crypts are still visible under a higher power, but are not well defined. These appearances are best seen in the small flakes of membrane, less distinctly in the larger masses, and not at all in the finer networks that are sometimes passed. These masses appear to be due to the formation of the mucous and epithelial matter, either upon the surface of or in contact with some follicular mucous membrane.

The product of diseased action in mucous membranes occurs in three varieties: First, a clear, jelly-like, and imperfectly membranous substance; second, yellowish, semi-opaque, flaky, and usually membranous; third, yellowish-white, dense, opaque, distinctly membranous, tough and rather adherent to the subjacent surface. Osler says that in cases of mucous colitis intestinal sand may be passed at intervals for months. I have never seen it passed in this way, nor have I ever seen it associated with mucous colitis, although many observers record it as a frequent concomitant.

The **diagnosis** presents but few, if any, difficulties. The colon seems to be generally the selective site of the disease. This is not always the case, however, as the small intestine may be invaded, either in conjunction with the colonic deposit or entirely independent of it. If mistakes arise, they are due more to the carelessness of the observer than to any obscurity in the signs of the disease.

I have known the membranes to have been considered to be ascarides lumbricoides, or the white, shining, detached pieces to have been mistaken for segments of the tænia mediocanellata, tænia solium, and the bothriocephalus latus. It has also been mistaken for fatty discharges. In puerperal fever, scarlatina, pyemia, and tubercular disease a membrane occasionally forms and is cast off. A mass of undigested food may resemble the discharge of mucous disease. Schubler gives a plate illustrating peculiar branching tubes, passed per rectum, which were the arteries and ligaments derived from the meat diet of the patient. In other cases the mass will be made up entirely of yellow elastic tissues which are derived also from the tendons in the meat diet of the individual. Test lavage of the colon after the method of Kuhn, which may allow us to reach the cecum, is often of great diagnostic aid.

We no longer believe that a so-called colon tube can with any certainty, by the usual methods, be introduced into the colon. The only way to introduce it correctly is through the sigmoidoscope. Mummery says that it is very doubtful whether a tube can be passed up the bowel for more than 6 inches once in twenty times, and the so-called high enema given with a long tube could be just as well administered with an enema nozzle—a statement with which I am absolutely in accord.

Prognosis.—The prognosis in relation to cure is essentially bad; most cases run a prolonged and tedious course, in many extending over the largest part of adult life. The disease of itself, uncomplicated, rarely or never proves fatal; the recorded cases of death are totally independent of the mucous affection.

Treatment.—The treatment may be considered under three headings—the prophylactic, the active, and the treatment of the underlying conditions (neurotic).

We must consider the treatment which is appropriate during an interval or remission, and that which we will resort to during an exacerbation. The treatment during an attack practically resolves itself into the relief of pain. This should be accomplished, if possible, without the use of opium, on account of its constipating effect. A suppository containing codein, heroin, or dionin in combination with belladonna will often suffice if accompanied by hot applications to the abdomen. In other cases, however, the pain will be too severe to be thus relieved, and we will be compelled to resort to morphin, which is best exhibited in a small dose, hypodermatically, in combination with heroin—$\frac{1}{8}$ grain of the former and $\frac{1}{12}$ grain of the latter. If the patient is put at rest in bed, much smaller doses will be efficacious.

Mummery uses belladonna to prevent spasm of the colon in the following combination:

℞. Tinct. hyoscyami	ʒss
Tinct. belladonnæ	♏vj
Sodæ bicarb.	gr. xx
Tinct. zingiberis	♏xv
Spts. chloroformi	♏xx
Aq. menth. pip.	ad. ℥j

Misce. One ounce three times daily.

This will not be so constipating, but we must administer a laxative at the same time, and personally I prefer in these cases some of the standard preparations of the fluidextract of cascara sagrada, assisted later by a colonic washing with salt solution. It is important to exclude all irritants, as soap, glycerin, and the like, as they will produce a severe enterospasm.

During the interval between attacks the diet, the constipation, the neurosis, and the complications must all receive their appropriate treatment. Arsenic in full doses is recommended, and may do good in some cases.

The Diet.—While the von Noorden diet of food rich in dross, shells, and fine seeds is theoretically correct to relieve constipation, I have never found it applicable in these cases of mucous disease; it seems to aggravate the already irritated intestinal tract and adds to the discomfort of the patient. Even if we draw the line sharply between an actual enteric catarrh and a mucous colic, with intact mucosa, we still think that this diet, rich in indigestible matter, is inappropriate. The diet may be along the lines suggested by von Noorden, whose principles are absolutely correct, but made somewhat milder and less irritating.

The appended diet table is one that I have had printed and am accustomed to hand to these patients. It should be explained to them that we wish to use foods that leave a bulky residue, to stimulate the muscular coat of the intestines, because the diet is rather unattractive, and it requires considerable pluck to adhere to it, year in and year out.

Diet List

Patients may take:

Soups: Broths, oyster soup, sorrel soup, soup made with beer or wine with grated bread, soups made from fresh herbs, leaves, or roots.

Fish: All kinds boiled. White sorts broiled. Sardines in oil. (Fish has little influence in relieving constipation and is introduced for variety.

Meats: Most kinds, poultry, game, meat fats, meat salad and jelly, ragout, etc. Amount of meat to be limited.

Fats: Butter (large amount), olive oil, cream.

Farinaceous Food: Brown and graham breads, gingerbread, oatmeal porridge, bran bread, bran pudding, whole meal bread, corn bread, German breads made with sugar, raisins, and currants, fruit cake, pudding, bread pudding with fruit sauce.

Vegetables: Most fresh varieties (well boiled), spinach, boiled onions, Brussels sprouts, cauliflower, salads with oil, lettuce, asparagus, tomatoes, salsify, celery, cabbage, rhubarb, carrots turnips, etc.

Dessert: Prunes, tamarinds, baked apples, oranges (on rising), melons, grapes, raisins, stewed fruits, honey and treacle. Fruits may be used in considerable quantity. If gastric hyperchlorhydria exists, acid fruits are contraindicated. It is well to eat after each meal some fresh or cooked fruit.

Beverages: Glass of water, preferably hot, drunk on rising (add salt to taste). Pure water plentifully, lemonade, beer, ale, weiss beer, grape juice, cider, currant wine, sour buttermilk.

Patients must avoid:

Tobacco, coffee, tea, mucilaginous soups, boiled-out meats, red wine, claret, Burgundy, chestnuts, pork, goose liver, hard-boiled eggs, salt meats, salt fish, peas, beans, nuts, new bread, white bread, pastry, pickles, spirituous liquors.

General Directions.—Should rest after meals. Long rest is harmful. Considerable exercise. In morning glass of cold water before eating. Anticipate call of nature every day at same time. If abdomen is not tender, massage it personally. Start at the bottom on right side, then straight up and across to left, then down. This to be continued for fifteen minutes. A five-pound leather-covered cannon-ball is often most useful for this manipulation. Surf-bathing is most efficacious.

Many patients will be unable to take any but the blandest foods, and a dietary such as the above is far too liberal and must be materially modified. Hence it is well to remove from the list all articles which in any way may act as mechanical irritants; then we must stimulate intestinal peristalsis and overcome stool retention in other ways.

Many of the patients will have a diarrhea, and then diet must be greatly modified to suit their special indication. Many of the cases have an alternating diarrhea and constipation, the former occurring most of the time and the latter occasionally.

The internal use of natural mineral waters has not proved of much benefit in my hands. I have certainly not seen a single case markedly improved by their use, and in many they seem to aggravate all of the uncomfortable symptoms.

If it is necessary to use purgative drugs, the milder laxatives should be selected; drastic purges will make the patient extremely miserable for days or weeks. My preference, as already stated, is cascara sagrada, but rhubarb, castor oil, licorice powder, and possibly aloes may also be used, sometimes with great advantage, but always with caution.

White says that if the large bowel is kept in an empty condition by the use of castor oil, the case will probably recover. Colonic irrigation is of extreme value, not alone to remove the accumulated mucus and decomposed intestinal debris, but it also has a happy local effect. We must remember that it is often quite impossible to remove all the mucus; postmortem study has shown that mucus is often so strongly adherent to the bowel wall that it is not removable even if a strong stream of water is allowed to play directly on it.

My plan has been to wash the colon with physiologic salt solution daily for perhaps a week, and then, in accord with Kussmaul and others, to use large enemas of pure olive oil in which the fatty acids have been removed by shaking with water. The enema is given at bedtime, allowed to slowly run into the colon, and is to be retained overnight, because portions of the bowel may not be reached by simple injection, owing to spasmodic contraction, and hard masses of fecal matter may be allowed to remain if simple water enemas are used; thus a constant irritation of the bowel persists.

Patients can retain from 250 to 500 c.c. of this pure, unirritating, acid-free olive oil. Of course, if it is repeatedly rejected a smaller quantity is to be used. It may be useful to give a mild narcotic and allow the patient to fall asleep, thus assisting the retention of the oil. When the patient awakens, the oil, feces, and masses of mucus are passed all together.

This treatment is to be persisted in for a long time, probably for six months—at first daily for two or three weeks, then every other day for perhaps a month, and three times a week for the remainder of the period. I cannot say that in this way it is possible to promise cure, but I can say that this plan, in conjunction with a proper diet and a proper mode of living, has done more for me than any other method that I have used for more than twenty years. Some writers advise the addition of bicarbonate of soda to the salt solution enemas, and it is often efficacious. We use 3 or 4 grams to the liter, and it seems to bring away larger masses of mucus.

I agree with recent writers that many of the neurasthenic symptoms may be attributed to the toxemia due to absorption of toxic substances from the intestinal tract, but I do not agree with the statements that the administration of drugs known as intestinal disinfectants will combat the condition. Intestinal disinfectants in my hands are without value. For disinfection I depend entirely upon the irrigation with salt solution, and perhaps the administration of minute doses of calomel, $\frac{1}{40}$ to $\frac{1}{20}$ of a grain, from time to time. I am positive that the addition of chemical substances to the irrigating fluids is harmful in most cases.

The neurasthenic symptoms demand the well-known methods of treatment that are applicable to these neuroses; we will not detail them here. Many of these women—for the disease usually occurs in women—suffer from abdominal complications, often a general ptosis, or an enteroptosis or nephroptosis. The only one of these that in my hands has secured any relief from surgical manipulations is the nephroptosis or floating kidney. In these cases the restoration of the organ to its proper position is apt to be followed by a most marked alleviation of the neurasthenic state; the others are to receive the general treatment laid down in another part of this work. In my opinion gastroptosis, enteroptosis, and hepatoptosis are non-surgical conditions, and are alone to be considered as in the domain of the medical practitioner.

It has been claimed, notably by Francke, W. Hale White, and Golding-Bird, that membranous colitis may be cured by making an artificial anus at the termination of the ileum, thus keeping the colon entirely free from food. White particularly makes the point that an empty colon is a sine qua non. This has certainly not always been my experience. While I have never performed nor advised the performance of this operation for the treatment of mucous colitis, unless the diagnosis of an inflammatory condition could be made with a reasonable degree of certainty, I have seen two cases, in which the diagnosis was not clear, so treated by other operators, and certainly the relief, after a fair trial of the distressing state of a patulous anus in the abdominal wall, was not at all marked; certainly not enough benefit was obtained to warrant the disagreeable state produced by the operation, particularly when we remember that the advocates of this treatment say that the opening must remain patent for at least a year, and then it is often difficult to close it.

These remarks apply also, in my experience, to the operation of opening the appendix and allowing it to remain patulous in order that the colon may be directly washed out in that way. Neither have I ever performed this operation nor advocated it, and the two cases that I have seen in consultation strengthen my belief that it, too, is not justifiable in the therapeusis of mucous disease, except those of an inflammatory nature, cases of true chronic colitis.

In women special attention should be directed to the sexual apparatus, and if the uterus or adnexa are diseased, measures should be taken to correct them. Great care must be exercised, however, to prevent advising unnecessary operations on these women. A recent writer has said that a woman with a subdeveloped muco-membranous enterocolitis who escapes an abdominal section for supposed utero-ovarian disease may consider herself a lucky individual.

If the analysis of the gastric contents warrants it, and the presence of old gastric or duodenal ulcer is excluded, the administration of hydrochloric acid will often make the patients suffering from achylia gastrica more comfortable; so, also, will strychnin or nux vomica in those who suffer from colonic atony.

Electric enemas have been indorsed in the treatment by as good an authority as W. Hale White.* About ten treatments may be given with a 0.1 per cent. solution of $AgNO_3$. After a preliminary lavage of the bowel, 1½ pints of the silver nitrate solution are injected through a colon tube which contains a copper wire that is to be connected to the positive pole of a battery. Large clay electrodes are placed on the abdomen and back and connected with the negative pole. A current of from 15 to 20 milliamperes is then passed for fifteen minutes. This treatment is said to produce natural movements, both in frequency and in consistency. The mucus disappears and flatus is absent.

We wish to make it very clear that the only hope for cure and for permanency of cure is to establish a normal action of the bowels, not only while the patient is under our personal observation, but for all the rest of the life of the individual. This must be done by the ingesta alone, and it is after we have established this action by the means above detailed that we fully indorse the principles, and to a certain extent the dietary, suggested by von Noorden. As soon as the spastic constipation with colica mucosa is removed and the action of the bowels is normal, the disease may be considered as cured.

But we must clearly understand just what is meant by normal bowel action. Even if the color, consistency, form, and chemical composition of the feces are normal, the action of the bowels cannot be considered to be normal if laxatives of any kind, massage, injection, or suppositories are required to promote bowel evacuation.

Not alone, then, must the bowels be absolutely normal, but we must improve the general nutrition if we wish to attain and maintain a permanent cure. The choice of foods must then be selected with this dual purpose in view: the relief of spastic constipation and the upbuilding of the patient. If this happy combination can be made, we may almost certainly promise a permanent cure. Von Noorden increases the fats enormously and gives from 200 to 250 grams of pure fat a day. He finds that but a few cases will be unable to take this great amount. This is not our experience. We do agree with him absolutely that we must individualize carefully in each case, and that diet lists are serviceable only as indications, and not as an absolute guide. We append von Noorden's diet list in addition to the one that we are accustomed to use:

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* Lancet, Oct. 28, 1905.

Von Noorden's Diet List

In the morning in bed at seven o'clock: Three-tenths of a liter of milk and cream (two parts of milk and one part of thick, sweet cream). Rub with moderately cold water.

At eight o'clock: One-fourth of a liter of Kissingen, Racoczy, or Homburg-Elizabeth water.

At nine o'clock: Three-tenths of a liter of the milk-cream mixture or of thin tea or coffee with much cream; sometimes, too, cocoa prepared with cream or butter and sweetened with sugar of milk. In addition, 50 to 70 grams of bread containing much cellulose, and 30 to 50 grams of butter.

At ten-thirty: If necessary, a massage of the intestine or hydrotherapeutic treatments of different kinds, sometimes electrization of the colon.

At eleven o'clock: Soup made from leguminous plants boiled with bacon or Westphalia sausage; in addition, graham bread with plenty of butter. Also a glass of breakfast wine or a small glass of brandy.

At one o'clock: Some meat dish, as much as wanted. In addition, vegetables of different kinds; boiled or baked potato with butter. Fruit with coarse skins and large seeds, as currants, gooseberries, boiled cranberries, or a pound of grapes. One-half a bottle of light young Moselle wine. After eating, rest in bed for an hour and a half with hot applications to the abdomen.

At four o'clock: A light lunch similar to the breakfast at nine o'clock. Then a walk of one and one half hours.

At seven o'clock: Supper like the dinner; sometimes, too, junket or fruit soup. In addition, 50 to 70 grams of graham bread with plenty of butter.

At nine o'clock: Three-tenths of a liter of the milk-cream mixture, as in the morning.

On the first and third day of the treatment an oil clyster is usually given in the evening in order to prevent all disturbances that might possibly arise. It is rarely necessary to repeat this later on. The average quantity of cream consumed amounted to $\frac{1}{2}$ liter a day. In the cream that von Noorden used this represented one and a half grams of pure butter fat. Daily average of butter equaled 230 grams. Average quantity of graham bread was 200 to 250 grams.

Patients are kept in bed for the first few days. If the diet at first causes some distress, hot compresses on abdomen and possibly suppositories of $\frac{3}{5}$ cgm. extract of belladonna and the oil injections. After the first two to four days the stools assume a normal consistency and a normal appearance. As soon as this occurs, all disturbances usually disappear. Mucus is passed, however, for some time longer, but the mucus is freshly secreted and there is no accumulation of this decomposed matter. If the cure takes a normal course, the secretion of mucus does not continue for more than a week.

In at least one-half of the cases the secretion of mucus ceases at once, as soon as soft motions are evacuated, and never returns thereafter. Later the patient is to be gradually returned to a more normal and less rigorous diet. This change may require from four to twelve weeks to establish fully. The average duration of a systematic cure was four weeks; the minimum, three weeks; the maximum, six weeks. The gain in weight amounted to 6 kilos as a minimum, 16 kilos as a maximum, 10 kilos on an average.

This, then, is von Noorden's dietetic suggestion and general management of these cases of mucous colic, but I must confess that in my hands this treatment does not produce the indicated happy results here detailed. With me it is a much longer fight, and often a most discouraging one. Many cases do well for a time and then suffer relapse.

The Surgical Aspect of Mucous Colitis.—We have already deprecated the use of the appendix as an avenue for washing out the colon, through a patulous appendix which has been stitched to the abdominal wall. This is not, however, the testimony of all observers; there are a number of writers who are enthusiastic in the praise of this procedure. They believe that the operation is indicated in all chronic inflammatory diseases of the colon.

As Tuttle* says, it has been chiefly employed in chronic amebic dysentery, muco-membranous colitis, and syphilitic ulceration of the colon, and in all of these conditions it has proved almost universally successful. In cases of simple mucous colitis the opening may be closed when the bowels have become regular in their movements, without irrigation or laxatives, and the mucus has been absent from the stools for several weeks. Tuttle further thinks that the only disappointments from the operation, so far as he has heard, have followed too early closure.

Attention must also be called to the fact that mucous colitis often very closely simulates a typical appendicitis. There seems no longer to be any question that appendicitis is always a surgical disease, and

* Jour. Am. Med. Assoc., Aug. 11, 1906, p. 428.

that it is to be treated by operative measures at the earliest moment, but this very commendable haste has resulted in the performance of many unnecessary operations in those who are the subject of mucous colitis with normal appendices.

Dieulafoy has recently again shown the similarity in clinical symptoms of the two conditions. The patients have usually had one or more attacks of colitis. They are apt to be constipated, with alternating attacks of slimy, bloody stools, and they have pain in the region of the cecum, or perhaps in the ascending, transverse, or descending colon; or, again, all of these regions may be painful and tender at the same time. As most patients with appendicitis have had attacks of enterocolitis, the analogy becomes the more marked.

When we are unfortunate enough to open the abdomen under these mistaken premises, we find, grossly, an entirely normal appendix whose histologic examination confirms the microscopic appearance; nor do we find any adhesions in or about the appendix, and, worse than all, the attacks which the patient has previously had occur from time to time as before the operation.

If we give more time to the study of our cases, such diagnostic errors will hardly occur. The whole clinical picture of appendicitis is very characteristic, but we are a little too apt to accept the single symptom of right iliac-fossa pain as pathognomonic. Before a great while we shall again be accepting the term "typhlitis," which we have for many years tabooed.

The variety of appendicitis which is liable to be confused with an attack of mucous colitis really presents a characteristic, well-marked, clinical picture, and we should be readily able to recognize it. The patient, without prodromal symptoms, is suddenly seized with pain, but he who suffers from colitis will give a history of some pain and intestinal disturbances extending over many months or perhaps years. In both there is tenderness in the right iliac fossa, but the appendicitis subject identifies his pain closely with McBurney's point; he also has muscular rigidity, skin hyperesthesia, nausea and vomiting, and rise of temperature, whereas these symptoms are absent or but slightly marked in mucous colitis.

We do not wish in any way to restrict the axiom that early operation in appendicitis is the only procedure that insures the welfare of the patient, but we argue for pre-operative diagnosis. In our experience many times have the two conditions existed in the same patient, and the symptoms have overlapped, so to speak, and we cannot hope to cure a mucous colitis with a coexisting subacute or chronic appendicitis. The removal of the offending focus is essential to the restoration of the colon to its normal function.

The surgical treatment of mucous colitis, following the lead of Keith in 1894 and Golding Bird in 1895, has settled down to two general procedures:

First, by deflecting the fecal current from the colon through a right inguinal colotomy or cecostomy, giving the colon complete rest.

Second, by an opening in the colon through which it can be washed and kept clean. This was at first attempted through a so-called valvular opening in the cecum, but this has now been practically replaced by an appendicostomy.

The objections to the first method are many, mainly due to the fact that the feces are fluid and cannot be controlled, entailing skin excoriation and extreme discomfort. To overcome this, ileosigmoidostomy has been tried a number of times, but it too has objections, in that it permanently short-circuits the colon and permanently changes the normal course of the feces. Some—notably the English writers—do not think that this latter objection is valid. I do.

Left inguinal colotomy has no rational basis, as it does not get above the disease. Appendicostomy, then, is practically the only operation that may be advised for the surgical treatment of chronic colitis, and if the bowel is the subject of an organic demonstrable colitis, it will probably be relieved in a large proportion of the cases.

OTHER DISEASED CONDITIONS OF THE INTESTINES

INTESTINAL INDIGESTION

Insomuch as trypsin is the most important enzyme in intestinal digestion, it would seem better, as suggested by Lukjanow and indorsed by Hemmeter and others, to use the term "intestinal dystrepsia" for those indigestions which are directly dependent upon abnormalities in the intestinal activity.

Before we apply therapeutic measures to our cases it is essential that we make an accurate diagnosis and eliminate gastric dyspepsia, which may be done by a chemical and microscopic examination of the gastric contents and a knowledge of the size and position of the stomach. We then must decide whether the intestinal indigestion is organic, with a demonstrable anatomic alteration or abnormality, or whether it is entirely functional, or whether the two conditions overlap, as they often do.

The classification of Hemmeter is to our minds the best, and it is here reproduced:

1. Intestinal indigestion due to pathologic-anatomic alteration in the structure of the intestinal walls, nerves, lymphatics, or blood-vessels. These are the dystrypsias that occur in association with the various forms of enteritis or enterocolitis, intestinal ulcers, neoplasms, obstructions, stenosis or displacements.

2. Absence or deficiency of the intestinal digestive secretions, especially the bile and pancreatic juices.

3. Intestinal indigestion due to qualitative or quantitative irregularities in the diet. Three sub-types: (1) Diet excessive in quantity, not transformed by amount of digestive secretions present; (2) diet normal in quantity, but irregularly and unhealthfully mixed, may be either too much fat, too much proteid, or too much carbohydrates; (3) diet contains abnormal injurious substances, either in the form of

toxins, the result of putrefaction and fermentation in the diet, or chemical substances that may have been added by accident or for therapeutic reasons. Many chemicals and medicines taken for the relief of gastro-intestinal or other diseases exert a deleterious effect upon the normal course of digestion.

4. Intestinal indigestion due to abnormal bacterial activity.
5. Intestinal indigestion due to abnormal gastric chemistry.
6. Intestinal indigestion of nervous origin—neurasthenia intestinalis.
7. Intestinal indigestion due to abnormal substances or irritants reaching the intestines from the blood, as the dyspepsias occurring in uremia, malaria, septicemia, croupous pneumonia, erysipelas, influenza, cholera, icterus, diabetes, gout and uric acid diathesis, diseases of the blood and blood-making organs, rachitis, osteomalacia, etc.
8. Intestinal indigestion due to intestinal parasites, worms.
9. Intestinal indigestion due to hyperperistalsis or excessive motility of the bowel.

In a work such as this we shall endeavor only to consider the etiology and diagnostic factors as they bear upon therapeusis; the more obscure problems and the moot questions in diagnosis can find no place here. Those cases that are due to pathologic-anatomic alterations must be studied along the general lines of clinical medicine, and will probably eventually be referred to one or other of the special branches of medicine or surgery, but the other classes coming under the remaining eight divisions of the subject must be submitted to immediate and careful study by the general practitioner who is to apply the therapeutic measures for their relief; without this study it is impossible for him to prescribe the appropriate measures.

A study of the absence or deficiency of the intestinal digestive secretions demands a thorough knowledge of the physiology of the digestive processes in both the stomach and the intestines, and this we have not space to consider. In a broad way, then, intestinal indigestion is due to alterations in the succus entericus (intestinal juice), the bile, or the pancreatic juice, or to alteration in all of these combined.

Of the first we unfortunately know but little, definitely; but of disturbances in the function of the liver and pancreas much is known. We shall not attempt to enumerate all of the probable functions of the liver, and as yet the part that bile plays in digestion is still in controversy. We do know that exclusion of the bile from the intestinal tract will greatly reduce the quantity of fats absorbed; perhaps they will be reduced as much as one-half.

The absence of bile also changes the relation between neutral fats and fatty acids; the feces will then contain an excess of fatty acids. Normal feces contain from 2 to 2½ parts of free fatty acids to 1 part of neutral fat, but these may contain 9 parts of fatty acids to 1 of neutral fat.

The pancreatic juice is materially aided in its fat-splitting properties when bile is present. Absence of bile causes decreased peristalsis, and the antiseptic condition is also modified.

The chemical processes in the duodenum are of vital importance, and are very complicated and not very well understood. They are easily upset and give rise, sometimes, to obscure symptoms in the intestinal tract that can be unraveled only by careful clinical and chemical studies.

An important matter for the clinician and the therapeutist is to determine the presence or absence of putrefaction in the intestine. Many writers, Hemmeter and myself among the number, think that the urine will aid us here, and that the amount of sulphate of indoxyl and the amount of total sulphates indicate the degree of putrefaction.

As a further diagnostic aid we may attempt the intubation of the duodenum, as suggested by Kuhn and the writer above referred to. The manipulation is a difficult one and is surrounded by many difficulties, but it is a justifiable procedure to attempt.

The duodenal test meal consists of weighed amounts of proteids, carbohydrates, and fats, and the chemical analysis of the filtrate shows the adipolytic, amylolytic, and proteolytic power of duodenal digestion. Before aspirating the duodenum the gastric functional activity must be known; particularly must we know whether there is hyperchlorhydria or achylia gastrica, and we must exclude the presence of duodenal ulceration.

If we adopt Kuhn's method of duodenal intubation, we must know when gastric digestion is finished; to do this we must make several tests of the rate of gastric peristalsis in a given case. When the stomach is nearly empty,—that is, when about three and a half hours have elapsed for a stomach that requires four hours to empty itself,—we introduce about 8 or 10 ounces of warm distilled water and allow it to run out, repeating this until the stomach is clean and empty. We then attempt to withdraw the duodenal contents by either the Hemmeter method* or by the method of Franz Kuhn,† which is more practical than the former, as the necessary instruments are much more simple and enter the duodenum with greater ease and certainty.

Space will not permit a description of the instrument here, but suffice it to say that it is a built-up tube of four different parts, one ensheathed in the other. Before the instrument is introduced we must determine the size and location of the stomach and the location of the pylorus. This latter we do with Kuhn's balloon sound. The Kuhn tube is used as an ordinary stomach-tube, but its different behavior to that tube is well illustrated in the accompanying sketches (Figs. 21 and 22).

The knowledge that we have already gained in each case by a previous careful study of the sketch assists very much in passing the tube into the duodenum. We may guide the tube from the outside, and also aid by the use of gentle massage, but after some practice it can be passed without these accessory aids. One should first pass it many times on dogs before attempting its use in the human being. We use it frequently in the dog laboratory of the University of California at Los Angeles, and we are unable to discover the slightest abrasion or insult to the gastric or duodenal mucosa when properly and gently handled. It is a great step forward from the attempt of Boas in 1890* to force the contents of the duodenum into the stomach by massage and to withdraw it by the stomach-tube, and from the early efforts of Türck, in 1895.†

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* Bull. Johns Hopkins Hosp., vol. vii, No. 61.

† Münch. med. Wochen., No. xxix, July, 1896, S. 674.

As already noted, the duodenal test-meal consists of weighed amounts of proteids, carbohydrates, and fats, as prepared under the directions of Chittenden; it may be made up of standardized solutions of pure starch, fibrin, and pure sterilized oil, all carefully weighed.

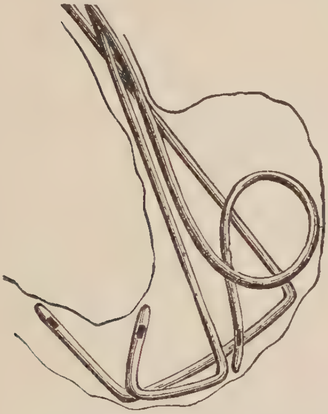

Fig. 21.—Action of an ordinary stomach-tube on attempting to push through pylorus (Hemmeter).

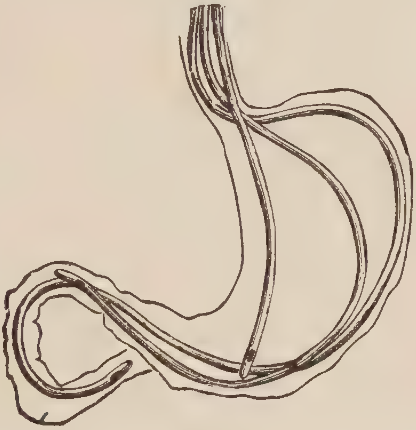

Fig. 22.—Kuhn duodenal tube passing through the stomach (Hemmeter).

We will then be able to determine the presence of the proteolytic, proteid-digesting ferment, trypsin; of the amylolytic, starch-converting ferment, amylopsin; of the lipolytic, fat-splitting ferment, steapsin; and of a milk-curdling ferment.

The duodenal juices are a mixture of bile and pancreatic juice in varying proportions; the latter also contains about 10 per cent. of proteids, and Pawlow has shown that olive oil is a decided stimulant to the secretion of pancreatic fluid. It has also been shown that the pancreas is more active when the stomach is normal in both secretory function and motility.

The pancreatic ferments are much more active when in the presence of normal amounts of HCl and gastric ferments. The absence of HCl removes a powerful stimulus to pancreatic activity. If bile is absent from the duodenum, the pancreatic ferments will be very inactive, if secreted at all.

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* Zeit. f. klin. Med., Bd. xvii, H. 1 und 2, S. 155.
† Medico-Surg. Bull., N. Y., July, 1895, vol. viii.

We must remember that alteration in the so-called external secretions of the pancreas will produce digestive disorders, and that alterations in the internal function of the gland will give rise to glycosuria. The independence of these two important functions has been demonstrated beyond argument. We know that the pancreatic ferments are derived from the secreting alveoli, and that the islands of Langerhans, which have no connection with the pancreatic ducts, control the assimilation of sugars.

All cases of intestinal indigestion should be submitted to stool examination by the Boas stool-sieve, which is a quick and practical method for determining the amount of undigested food. Of course, it is also desirable, in many cases, to make a careful quantitative analysis of the stools after weighed amounts of proteids, fats, and carbohydrates have been eaten; but for every-day work the above will be sufficient, and in cases of faulty digestion the presence of unaltered muscle-fiber in the feces may be readily determined.

Sahli's method may also be tried, which consists in exhibiting a gelatin capsule hardened in formalin and filled with iodoform. The formalin-hardened capsule is unaffected by gastric digestion, but is is dissolved by pancreatic juice.

If the gastric motility is normal, the urine or saliva will give reaction in four to eight hours. Delayed or absent reaction indicates impaired or absent pancreatic digestion. Steatorrhea usually follows the loss of pancreatic secretions. In some instances the fat in the stool may be fluid and oily, and in others it can only be recognized by microscopic study or chemical analysis.

The voluminous character of the fecal discharges in cases of impaired pancreatic digestion has been considered to be of diagnostic importance by Osler; it is due to the fact that much of the food material passes through undigested. Some cases of intestinal indigestion are essentially surgical in nature, particularly cases giving a history of cholelithiasis with marked and rapid emaciation. A considerable number of these cases are now on record, and the practitioner should remember them when treating cases of intestinal indigestion with marked emaciation and submit his cases early to surgical interference. Much may be done by early cholecystotomy and gallbladder drainage; the intestinal indigestion will cease and the patient will rapidly regain health and strength.

Opie has shown that bile injected through the pancreatic duct into the pancreas will produce an acute hemorrhagic pancreatitis. In the human subject stenosis of the ampulla of Vater or partial occlusion by gall-stones may cause the bile to flow into the pancreatic duct.

If the intestinal indigestion comes under the third subdivision of our subject, qualitative or quantitative irregularities of the diet, it may be readily corrected by regulation of the intake and slow eating. Food must be masticated and mixed with saliva, else trouble will arise later in the process of digestion. Some amylolysis should take place in the stomach. The food morsels should be small, as the digestive juices cannot penetrate those which are large.

A dyspeptic or dystryptic diarrhea will arise from improper combination of food, as fruits, cucumbers and milk, beer, spoiled or decomposed foods. This diarrhea is curative, and should not be checked by medicine; later, if it persists catarrhal changes in the intestines will arise and demand appropriate treatment.

A diarrhea will also often arise from absence of HCl in the gastric secretions. This may be readily arrested by the administration of the proper amount of the acid, determined after analysis of the gastric contents; in fact, it is impossible fully to understand and treat a case of intestinal indigestion without entire knowledge of the gastric functions too. If the intestinal disturbance is due to hyperchlorhydria, it may be corrected by sufficient alkalies to neutralize the excess of acidity; the amount to be given must be determined by careful analysis.

Great harm may be done the patient by the indiscriminate exhibition of chemicals, and the very drugs that are given to relieve a supposed dystrypsia may be the cause of it. Probably HCl and pepsin are more often given when not needed than any of the other drugs, but the bromids and salicylates, the astringents, bismuth and soda preparations, will all do harm under certain conditions. So also will iron, unless given in the proper dose and at the proper time, immediately after meals.

All of us who have treated many of these cases have time after time had patients referred to us who were taking HCl, when the stomach was already forming enough, or perhaps even an excess, of that acid.

For a number of years we have thought that we knew that normal digestion could be carried on with a total absence of bacteria. Many experiments on guinea-pigs and chickens have seemed to demonstrate this to be a fact, but the animals whose intestinal canals were maintained free from bacteria would first fail to gain flesh, then would lose weight, and within a few weeks die; while the control animals, fed on similar food, except that it was not sterile, would thrive and grow in the usual way; but some writers believe that bacterial invasion of the intestinal canal is not essential to life; those who believe this are now strongly in the minority.

The experiment of Nuttall and Thierfelder is often quoted in this respect. They secured a guinea-pig from its mother by Cesarean section and maintained it in an absolutely sterile condition, also feeding it on sterilized foods. The animal thrived, and in eight days was killed. But this seems to have been too short a time to make absolute conclusions; perhaps if the pig had been allowed to live longer, it would not have thrived on this sterile diet; although Levin in Spitzbergen has studied the intestinal contents, and finds that the bears, seals, and reindeer have sterile bowel contents. These animals live in a region in which there is great scarcity of micro-organisms in both the air and water.

As early as 1874 Billroth showed that the intestinal contents of the new-born are always sterile, and Popoff has shown that the bacteria appear in the bowel contents soon after the first nourishment is given. Escherich has demonstrated beyond argument that the bacillus coli is the characteristic organism in the human intestine, and that it remains so throughout the life of the individual, but its exact origin has as yet never been satisfactorily determined; it seems to enter through the mouth with the food. Many transient organisms are also introduced, but Miller tells us that at the end of nine hours the stomach will contain no organisms. This, of course, presupposes that the individual has the normal output of HCl.

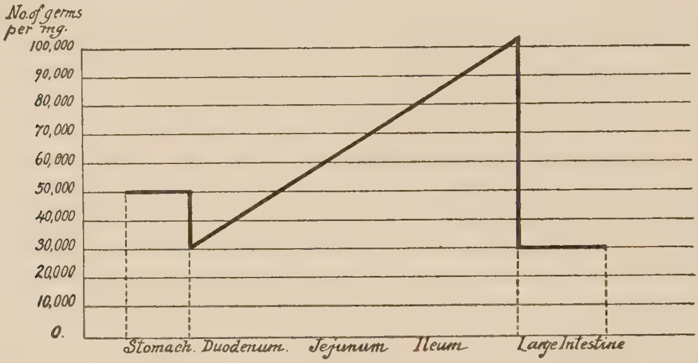

Fig. 23.—Gilbert and Domenici's diagram showing the relative number of bacteria present in the contents of different parts of the alimentary tract. The dogs were killed three hours after a meal of bread and meat. Examination of the intestinal contents at this stage of digestion showed an abundance of organisms in the stomach, a pronounced diminution in number at the duodenum, followed by a gradual rise to the ileocecal valve, where bacteria flourish in the greatest luxuriance. When the large intestine is reached, there is a marked falling-off in the number, with a slight rise proportionate to the distance from the cecum (Harvey Cushing).

The duodenum has but few bacteria, but as we proceed downward they increase, until the maximum bacterial content is found at the ileocecal valve, passing this point to again decrease. Cushing has been able to study this matter in cases of intestinal fistulas. A jejunal fistula would return a glass of milk in a few moments after its ingestion, with its bacteriologic content practically unchanged; but if the food is solid, it will remain in the stomach several hours, and hence have its bacteriologic content much reduced before it is passed into the duodenum.

The conclusions from the studies of Cushing and others are:

1. The stomach contains, immediately after a meal, a number of

micro-organisms of different varieties, according to the nature of the food administered.

2. If the food is given in liquid form, it is rapidly passed onward into the intestine, and the bacterial forms are but slightly, if at all, affected.

3. If food is given in a solid form, it remains longer in the stomach, and the number of bacteria contained therein undergoes a steady diminution until digestion is complete. The empty stomach is then amicrobic.

4. The duodenum is often sterile; the number and virulence of the bacteria of the intestine increase in proportion to the distance from the duodenum, and attain their maximum at the ileocecal valve.

5. The bacillus coli communis is the characteristic organism of the human intestine; it is never absent after the first few days of life.

6. The stomach and upper part of the jejunum can be rendered sterile by administering only sterilized foods and by attention to the toilet of the mouth. In dogs starvation for a few days leaves the upper part of the intestine empty and sterile.

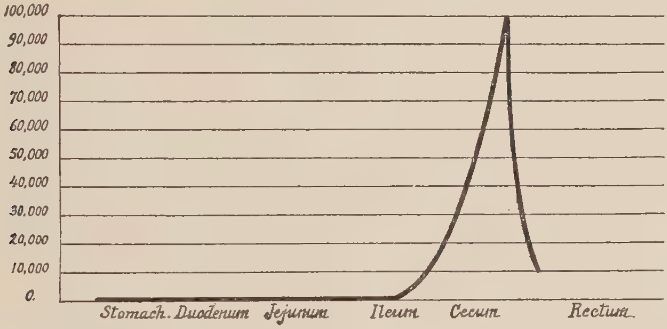

Fig. 24.—Harvey Cushing's diagram showing the relative number of micro-organisms at different levels of a dog's intestine after a prolonged fast.

7. The stomach and intestine, when their contents have been discharged and they are empty, are sterile. If the emptying is prevented by obstruction at the pylorus or in the intestine, the contents, dammed up behind the block, contain organisms whose number and whose virulence are greatly increased.

Instead of exhibiting the so-called intestinal antiseptics, we much prefer the plan of Cushing,* in endeavoring to render the intestines sterile, which is as follows:

"The procedure which we have employed is simple and mainly consists in an attempt to render amicrobic all ingesta. The mouth is rinsed with an antiseptic solution and the teeth are carefully brushed at intervals of a few hours, and with especial care before and after feeding. The stomach, if any chronic catarrh exists and micro-organisms in numbers are found present after a test-meal, is washed out carefully morning and evening. Food is taken in small amounts and at comparatively frequent intervals, from clean or, preferably, sterile vessels, and consists of boiled water, sterilized milk, beef-tea, albumin-water, and similar liquids. Patients with chronic gastritis have been seen to gain in weight under this régime."

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* Johns Hopkins Hosp. Reports, vol. ix.

The whole question is as yet too unfamiliar to find a place here. We do not really know what constitutes normal and abnormal bacterial activity in the intestinal canal, so we have long since ceased to depend on the so-called intestinal antisepsis. We do not possess any drug that will materially aid in rendering the intestinal canal even approximately free from micro-organisms, much less sterile. The only means that we have at our command for this purpose is the use of a sterile dietary; that is, thoroughly sterilized, easily digested food, given in small quantities.

If the bacterial activity is excessive, it is better to avoid eggs, as Bohai has shown how dangerous they may be; lecithin, cholin, and the very toxic neurin may be formed from them. The stomach and the colon may be washed with sterile water, but this is rarely necessary if the diet is properly prescribed.

Intestinal indigestion of *nervous origin* has already been considered, and we shall not further refer to this neurasthenis intestinalis.

General Consideration of the Treatment of Intestinal Indigestion.—A carefully selected and well adapted diet is absolutely essential to the proper treatment of these cases. As a general rule nothing that is raw or uncooked should be allowed. The food should be fresh and not handled much before being cooked.

All water should be boiled; distilled water is not advised except under special circumstances. Artificial soda-water, or the natural mineral waters, still or carbonated, are not to be recommended. The patient should, of course, avoid all forms of food or drink which experience has taught him are personally hard to digest. Above all, avoid overloading the stomach.

Rubbing the epigastrium is recommended, particularly cold rubbing. During the heated term the patient is to be sent to the seashore or the high mountains, as the individual may elect.

DIETARY

Clean and disinfect the mouth before eating. Small meals taken at regular intervals. Punctuality is of great importance. Masticate thoroughly; eat slowly and temperately. Food lukewarm only. Rest before and after meals.

The patient may take:

Soups: Small quantity. Clear soups of beef, mutton, and oyster. A little vermicelli or tapioca may be boiled with these. Cream pea soup, pea and tomato soup, hominy and bean soup, beef-tea with yolk of egg.

Fish: Oysters and little neck clams in any form except fried. Weakfish, whitefish, shad, cod, perch, trout, bass, smelt, mackerel, haddock, corvina, barracuda.

Meats: Meat juice, roast or broiled beef, mutton, chicken, tripe, calf's head, venison, tongue, sweetbread. No fatty meats or sauces.

Eggs: Raw, soft-boiled, poached, omelette combined with chicken or oyster. Eat dry toast or stale bread with eggs. May combine eggs with wine or brandy.

Farinaceous Foods: Bread at least one day old; brown bread, toast, rye, gluten and graham bread, zwieback, crackers, cream crackers, cracked wheat, rice, sago, cornmeal, hominy, wheaten grits, vermicelli, rolled rye, rice cakes, browned rice, baked flour.

Vegetables: (Best made into purée by passing through a colander or mashing.) Greens, spinach, lettuce, water-cress, French beans, green peas, asparagus, celery, artichokes, potatoes (but little). All vegetables to be used sparingly and with caution.

Dessert: Rice, tapioca, Indian and farina puddings, custards (rice, snow, rennet, sponge cake, floating island), orange charlotte, gelatin creams, blanc mange, baked and stewed apples and pears, grapes and all ripe fruits (best stewed, but may have to avoid fruit entirely).

Beverages: (Drinks should be mostly taken near the end of meals.) Water one hour before meals, milk lime-water, weak tea (½ ounce to the pint), koumiss, weak cocoa, peptonized cocoa and milk. Mineral waters are not specially recommended. Good claret or Burgundy diluted one-half with sterile water.

The patient must avoid:

Rich soups and chowders, all fried foods, veal, pork, liver, kidney, hashes, stews, pickled and corned meats, preserved and potted meats, turkey, goose, duck, sausage, salmon, salt mackerel, bluefish, sturgeon, eels, shrimps, sardines, lobster, crabs, cabbage, cauliflower, cucumbers, parsnip, egg plant, turnips, carrots, squash, oyster plant, sweet potatoes, beets, pastry, pies, made dishes, nuts, dates, jams, dried and candied fruits, candies, cheese, whipped cream, ice-cream and water-ices, ice-water, pancakes, potato cakes, pumpernickel, strong tea, malt liquors, sweet and effervescent wines, spirituous liquors, coffee.

Study the stools daily, for a time, by the stool sieve, and learn what foods pass through undigested; avoid these or give in very small quantities. It is well always to accept the patient's own statement in regard to the class of foods that he knows will disagree with him, but the stool examination will, of course, afford us accurate information.

It is a difficult matter to say absolutely just what the diet should be for each given case; we must feel our way a little; some will do better on the proteids and others on the carbohydrates. All will do better without alcohol, tea, coffee, and tobacco.

The fermenting food-masses will increase peristalsis, and the contents of the upper bowel will be rapidly passed on through the entire intestine in practically an unaltered condition, in the more severe forms of intestinal indigestion. Here the jejunal stool must be recognized from that which is characteristic of enteritis, as there is a certain similarity, in that they both contain undigested food, feces, and large amounts of glairy mucus. The jejunal stool is acid in reaction, rich in bile-pigment, and has but a slight fecal odor; the stool from catarrhal inflammation contains epithelium and round-cells, but little bile, and is apt to have a strong decomposed fecal odor.

After the careful stool study, gastric analysis, and perhaps duodenal test-meals, we are prepared to place the patient on his proper diet, and perhaps cautiously to administer some medicinal agents, but the diet is the sheet-anchor.

As already stated, we have little if any faith in so-called intestinal antiseptics; bismuth and salol are probably the best, and are certainly the least harmful. In common with Hemmeter, I have seen absolutely no result follow the administration of orexin, as so strongly recommended by Penzoldt. I have not, however, seen diarrhea follow its use, as has the former observer.

For the drug treatment my main dependence has been upon a capsule of bismuth subcarbonate and salol, or these in combination with the essence of calisaya. If there is some achylia gastrica, I like a combination of dilute hydrochloric acid and elixir of gentian, which may also contain tincture of nux vomica; but I wish to repeat that it is to the diet and mode of life that we must look for permanent results.*

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* Many formulas have been given to the profession for the relief of intestinal indigestion; those that I have found the best are as follows:

For putrefactive diarrhea:

℞.	Tannigen	4.00 gm.
	Bismuth subgallate	8.00 gm.
	Salol	1.55 gm.
	Denarcotized extract of opium	0.20 gm.

Make into 12 capsules, or prescribe with 6 ounces elixir of gentian (Hemmeter).

For anorexia with fermentation:

℞.	Tincturæ nucis vomicæ	22.56 gm.
	Resorcin resub.	5.40 gm.
	Tincturæ amaræ	11.25 gm.

Mis. Ten to 15 drops, every two hours (Ewald).

For anorexia with gastric hypochylia in intestinal indigestion:

℞.	Tincturæ nucis vomicæ	9.30 gm.
	Essence of calisaya	60.00 gm.
	Diluted hydrochloric acid (P. D. & Co.)	15.00 gm.
	Elixir gentian	165.00 gm.

Mis. One-half to one fluidounce thrice daily, one-half hour before meals (Hemmeter, modified).

The Surgical Aspect of Intestinal Indigestion.—It will be necessary for the practitioner to keep himself fully *au currant* in this regard, as the field of gastric and intestinal surgery is constantly widening, and many of the diseased conditions that have been heretofore rather carelessly classed, and treated as dyspepsia, indigestion, chronic enteritis, catarrh, and the like, have a distinct anatomic basis in their etiology which can often be entirely removed by surgical interference at the proper time.

We must recognize that internal medicine and surgery are becoming more closely interwoven, particularly in abdominal diseases. Disease of the upper abdomen is a prolific source of gastric and intestinal indigestion. The lower abdomen, particularly its right quadrangle, must always be carefully studied from a surgical standpoint when we are called upon to treat a case of so-called intestinal indigestion.

On an average, as Naunyn says, every tenth human being has gall-stones; and of elderly women, perhaps every fourth has them. It is also probable that in nine persons out of ten who have gall-stones the disease is never recognized. In a large majority of cases the stones have never given rise to the so-called characteristic symptoms which would call attention to their proper etiology and elucidate this problem if we would give the matter proper attention. In other cases, however, their existence has been overlooked.

Almost all of these cases have for years suffered from "indigestion," "gastric catarrh," "spasms," "colic," "neuralgia of the stomach and intestines," "flatulent distention," just as the medical attendant has happened to style the condition. Nearly always the symptoms have been referred to disease of the stomach and intestines, and not to the true source—the liver and its biliary channels and ducts. This is mainly due to the fact that jaundice is an infrequent symptom of gall-stone disease, but both the patient and many physicians demand the occurrence of jaundice before their attention is directed to the liver. Moynihan says that this want of recognition of gall-stone disease in its earliest stages must be insisted upon.

The five cardinal symptoms of gall-stone disease upon which we may base a diagnosis are: Nausea and vomiting, pain and colic, fever, jaundice, tumor.

Moynihan's epigram says that the most common symptom of gall-stones is indigestion. The indigestion is relieved by an attack of

For anorexia:

℞. Extracti nucis vomicæ	0.024 gm.
Bismuthi subcarbonatis	0.520 gm.

Mis. Make 20 powders; one powder three times a day (Boas).

Mencke advises resorcin sublimate to improve appetite, to check fermentation, and for sedative action, in the following formula:

℞. Resorcin resublimate	2.0 gm.
Tinct. rhubarb	15.0 c.c.
Simp. elixir	q. s. ad.90.0 c.c.

Mis. Tablespoonful twice daily.

nausea and vomiting, so that in all patients who give a history of indigestion, nausea, and vomiting the existence of gall-stones should be ever before us, and a careful examination of the gall-bladder is imperative before placing the patient under treatment for his indigestion.

The adhesions about the gall-bladder, which no longer contain stones, may give rise to abdominal tenderness, with more or less serious vomiting and pain. Inflammatory processes may occur in a gall-bladder distended with fluid or stone and simulate an attack of acute indigestion very closely to the careless observer; this is also true of a dilated, calculous common duct or its tributaries, without the impaction of calculi.

Jaundice is unfortunately a rare symptom of gall-stone disease; it must be considered an inconstant symptom. If it occurred more frequently, the mistake of treating gall-bladder as intestinal indigestion would not so often occur. It occurred in only 14 per cent. of Murphy's cases at any time during the disease. When it occurs, it may be so slight as to be readily overlooked. Here the suggestion of Hamel will be valuable. He allows the blood from a puncture in the lobe of the ear to flow into a capillary tube. In a few hours the serum will collect on the upper part of the tube; if jaundice is present, no matter how slight, a yellow color will be noticeable in the serum.

The temperature of an infection or cholecystitis due to gall-stones and the like is most characteristic, and readily aids in the differential diagnosis. It has been aptly called the "steeple chart," with its abrupt peak-like elevation; it has also been styled the "temperature angle of cholangic infections." It is totally different from that seen in the acute type of intestinal indigestion.

The tumor of enlarged gall-bladder should be readily recognized. It is either banana- or pear-shaped, sometimes has great motility, and has been known to reach as low as Poupart's ligament, as in a case we recently saw with George Lasher, of Los Angeles. The edge of the liver can be felt above the tumor; the colon is below it, moves with respiration, but may be obscured by a thickened omentum or by adhesion of the colon or small intestine, or the "lobe of Reidel" may compress it.

Appendicitis is usually seen by the medical man, as the attack is often considered one of simple colic or acute indigestion; but only too often does the medical man forget Keen's aphorism: "The first indication in appendicitis is to call in a surgeon."

Let us then briefly consider the differential diagnosis between intestinal colic, acute and chronic intestinal indigestion, and appendicitis, in order to interpret correctly the necessary therapeutic measures to advise. It is only necessary to read Spellissy's paper in the "Annals of Surgery," 1902, vol. xxxv, p. 758, to realize fully the numerous mistakes in diagnosis that occur constantly. Particularly in children are the abdominal symptoms of appendicitis mimicked by disease of the other organs, notably those in the thoracic cavity.

Appendicitis is most frequently mistaken for acute indigestion. Intestinal colic, as far as pain is concerned, looks much like an appendicitis, but the other classic symptoms are absent. It may be accompanied by constipation early, but is usually followed by diarrhea; the abdomen may be swollen and tender, but the tenderness is not confined to McBurney's point, and localized rigidity is not marked.

In children an acute enteritis following a period of intestinal indigestion may set in with great acuteness, pain, vomiting and high temperature, sensitive abdomen, and legs flexed on thighs, but the frequent and offensive stools should elucidate the problem. If the inflammation extends to the peritoneal surfaces, it may simulate appendicitis very closely. So also in children will intestinal parasites give rise to symptoms of intestinal indigestion which by a sudden exacerbation will closely resemble an appendicitis, but we must also remember the converse of this proposition; intestinal parasites not only give rise to intestinal indigestion, but may also be the causative factor of an acute appendicitis. Here the blood examination will aid very much, as in helminthiasis a high grade of eosinophiles is frequently found, while, as Simon says, early in acute appendicitis there is often either a marked diminution or an absence of eosinophiles; they increase as the infection terminates.

Chronic lead-poisoning is accompanied by gastric and intestinal symptoms and constipation. When the colic occurs, following, as it does, this train of intestinal disturbances, we may mistake it for appendicitis, but the pain is here usually relieved by pressure, and the other cardinal symptoms of appendicitis are absent.

When treating cases of obscure abdominal conditions the *leukocyte count* will be a good aid in diagnosis. In intestinal indigestion, mucous colitis, and the like it is not affected; but if appendicitis is present, the leukocytes will increase, and the physician is justified in asking for surgical advice. It is not unusual to find a high leukocyte count, 20,000 or more, in a case with mild symptoms and a few local signs. It means, however, that an immediate operation should be advised. Unfortunately a low leukocyte count does not always mean that the disease is quiescent or that the patient is safe.

ACUTE CATARRHAL ENTERITIS

Acute catarrhal enteritis is most frequently seen in children, and particularly in those of the lower classes, although it may occur at any age.

Many writers have endeavored to too minutely classify the disease into anatomic areas, as duodenitis, jejunitis, and the like. As a matter of fact, the entire tract is apt to be involved; true, the small intestine the most intensely, but the colon may take part in the acute inflammatory change.

The disease is met with under two grand classes—either as a primary disease or as one secondary to other diseased conditions.

The former is caused by improper diet, particularly unclean milk in hot summer weather. In some people, however, we must remember that certain articles of diet will always produce a greater or less diarrheal discharge, not due to a catarrh of the mucosa, but rather to an increased peristalsis. Changes in the weather are perhaps the most important cause of all. A sudden fall of temperature of more than twenty degrees may cause an acute diarrhea, why we do not know; but above all is the prevalence of these cases striking during the hot weather of the large centers of population, both in a large portion of the United States and in Europe. The Pacific coast of our own country is peculiarly exempt from this hot-weather acute gastroenteric intoxication of infants and children. Changes in the succus entericus, about which we know very little, will excite a diarrhea; this is the bilious diarrhea of the older writers. Scanty secretion is more apt to produce fermentation, however, and a resulting intestinal catarrh, than is the excessive secretion to produce increased peristalsis and diarrhea.

Fatty diarrhea is seen when the pancreatic secretion is absent or diminished.

We will not consider the nervous influences in producing a diarrhea, as this scarcely comes under the head of catarrhal enteritis; rather is it an increased peristalsis, and is styled a nervous diarrhea.

The secondary causes of intestinal catarrh are numerous; the infectious diseases, as dysentery, cholera, pyemia and septicemia, typhoid fever, pneumonia, and tuberculosis, are often accompanied by acute intestinal catarrh. Inflammatory processes may extend from adjacent parts. Peritonitis is always accompanied by catarrh of the mucosa; so in hernia, in invagination, and in tuberculous or carcinomatous ulcerations of the intestine. Intestinal catarrh occurs in the course of Bright's disease, Addison's disease, malignant growths, and from circulatory disturbances in diseases of the liver, heart, and lungs.

Finally, we may class enteritis as either infectious catarrh or intoxicational catarrh. The first is the product of pathogenic microorganisms, either by their invasion or by their toxins; and the latter is due to chemical poisons, introduced with the ingesta, or developed from the ingesta by putrefactive changes, or they are derived from the blood.

The enteritis which follows extensive cutaneous burns must be remembered. Observers* have claimed to have isolated a ptomain from the blood and organs of animals with extensive burns. Injection of this substance would produce diarrhea and bloody stools. Duodenal lesions were not observed.

The morbid anatomy of acute catarrhal enteritis is not always as, characteristic as we would suppose in patients who during life presented apparently typical symptoms. The three cardinal changes, redness, swelling, and increased secretion, may be absent or but slightly marked. The mucous membrane may be hyperemic to varying degrees, depending on the intensity of the congestion, or it may be pale and covered with mucus. The congestion is most marked about the solitary follicles, the Peyer's patches, the summit of the folds, and the tips of valvulæ conniventes. If the inflammation is intense, the mucosa may be softened and infiltrated, the epithelium swollen or shed in flakes or sheets the result of postmortem changes. Extravasation of the blood is seen and the ecchymoses are of varying sizes. The solitary follicles in the large bowel may stand out prominently, with central erosions; these and those in the small gut are the so-called follicular ulcers.

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* Kijanitzin: Vir. Arch., Bd. cxxxi, S. 436.

This is one of the most usual forms of fatal enteritis in children, and it occurs irrespective of the intensity of the diarrhea. The muscularis and serosa are generally unaffected. The mesenteric glands, more particularly in secondary catarrh, are enlarged and hyperemic.

The **symptoms** of the acute variety vary somewhat, depending on the site, intensity, and cause of the disease. The symptoms of acute catarrh of the jejunum, ileum, and colon, which is the usual anatomic site, are fairly characteristic. The symptoms of catarrh of smaller segments of the intestine, as duodenitis, jejunitis, ileitis and typhlitis, colitis, and proctitis, have their own characteristics also, but their delimitation is a more difficult matter.

Primary acute enteritis arises suddenly, and its first marked symptom is diarrhea, usually preceded by more or less colicky pain, and abdominal fullness and distention; but the diarrhea may be the sole indication of the condition. It is to be remembered that diarrhea is not an invariable symptom of acute enteritis. Catarrh of the jejunum may exist without diarrhea; so also may the duodenum and sometimes the ileum be affected without diarrheal discharges. If the colon still functionates normally, diarrhea may be absent throughout the course of an acute catarrhal enteritis, the colon compensating the increased peristalsis higher up. This is often demonstrated on the postmortem table.

The stools vary in character and their color depends on the amount of bile with which they are mixed; they vary from a dark, blackish-brown to a grayish-white. Their consistence also varies from thin and watery to pultaceous, gruel-like masses.

The diminished absorption allows an accumulation of mucus and serum, so that the stools are often voluminous and apparently much out of proportion to the food intake. The number of bowel movements also varies from one or two to twenty per day, rarely more. Portions of undigested food can often be recognized, and if the catarrh is high up, Gmelin's reaction for unchanged bile will be positive, depending upon the rate of peristalsis. In children the stools are apt to be colored green from the beginning of the attack.

The microscope will show numerous micro-organisms, white and red cells, perhaps hematin crystals, epithelium and mucus-cells, various crystals of lime, granules of bilirubin; sometimes cholesterin and Charcot's crystals have been observed.

Pain in the abdomen is practically always present in acute catarrhal enteritis. It is colicky, and if there is colonic involvement it becomes tenesmus. Tympanites and gurgling noises or borborygmi exist.

Fever is rarely present, but there may be a slight elevation in temperature; if it remains at 102° F. or over for several days, we may suspect a commencing typhoid fever. Anorexia, great thirst, dry and coated tongue, and in the very acute cases vomiting and symptoms of collapse, make up the clinical picture. These attacks last from two to ten days, and usually end in recovery; in fact, the general health in light cases is but little disturbed, but severe cases often assume a grave aspect.

In rare cases the symptoms of Marshall-Hall's disease, acute hydrocephaloid disease, due to brain anemia from loss of water, may be observed; more frequently in children. In these little ones death often comes suddenly from cardiac paralysis, bronchopneumonia, or thrombosis.

It is important, if possible, to locate the site of the catarrh; certainly we should know whether the large or the small bowel is affected.

It is impossible to make an absolute diagnosis of catarrh of the duodenum except when icterus exists in consequence of obstruction to the ductus choledochus from stones or swelling of its mucous membranes. It is perhaps safe to make a diagnosis of duodenitis after extensive skin burns, as the poisonous toxin that here arises is secreted by the bile into the intestines; it may cause ulceration and perforation of the duodenum. An isolated jejunitis or ileitis cannot be diagnosed; these conditions cannot be separated from the general catarrhal enteritis.

It is comparatively easy to determine whether the large or small bowel is affected, and we must assume that the methods of differential diagnosis are well known. Granted that we decide that the small bowel is affected, we must then not confuse this with stercoral dyspeptic or nervous diarrhea, and it is only by a careful examination of the evacuations that a sure diagnosis can be made. Macroscopic and microscopic mucus is absent in the other forms of diarrhea.

The presence of mucus in the stools is a most important diagnostic aid; for example, pure mucus without feces usually means a proctitis, sigmoid or descending colon catarrh, or the feces from these regions may be globular and wrapped about with mucus.

If the mucus and the feces are very intimately mixed, the higher part of the colon or the lower part of the ileum is usually involved. It makes little difference whether the fecal mass is solid, semi-solid, or liquid; it will indicate a catarrhal involvement of these sections of the gut. If the entire colon is affected, the thin stools will show an intimate mixture of small particles of mucus; large enough, however, to be recognized by the unaided eye.

If the mucus is only recognizable by the microscope, and is closely mingled with a firm or semi-solid stool, it indicates a catarrh of the cecum, and probably of the ascending and transverse colon. But the same microscopic condition is seen in catarrh of the lower part of the ileum, so that such a microscopic appearance shows a rather extensive involvement.

If the mucus passed is in small masses and granules, and is stained very yellow, it probably comes from a catarrhal small intestine. If marked increase in peristalsis exists, due to faults of innervation, the stools and mucus may be intensely bile-stained without any catarrhal inflammation being present.

Treatment.—Acute catarrhal enteritis in a strong adult is best treated by withholding all food for twenty-four to forty-eight hours. For the vomiting, ice and small quantities of soda-water will be efficacious. If the ingestion of a large mass of indigestible food has caused the enteritis, it is well to give castor oil or calomel. We prefer the combination of calomel triturates containing $\frac{1}{8}$ grain of calomel, ½ grain of sodium bicarbonate, and $\frac{1}{12}$ grain of ipecac; these are given every hour, unless the patient has already too freely purged. An emulsion of castor oil or the soluble elastic capsules may be used, and the effervescent citrate of magnesia is often most satisfactory. This, in combination with rest and a restricted diet, will be all that the milder attacks will require. In those who suffer a great deal of pain, some form of opium will be demanded. Many writers prefer laudanum for this, but I like either a hypodermic of heroin, gr. $\frac{1}{12}$, or morphin, gr. ⅛ to ¼, the best. A combination of chloroform and morphin is also gratifying, and I often use this formula:

℞.	Chloroformi	f℥j
	Morphinæ acetatis	gr. iss
	Olei anisi	
	Olei menthæ piperitæ	āā gtt. x
	Syrupi acaciæ	f℥ij
	Aquæ camphoræ	q. s. ad f℥ij
Mis.	Teaspoonful in ice-water p. r. n.	

Unless the diarrhea is very profuse, we must be careful not to check it too suddenly, as it usually stops without our aid in about forty-eight hours. If it persists, however, we may first try large doses of bismuth, aromatic chalk mixture, and sometimes a 3-ounce starch enema containing 30 drops of laudanum. Colonic enemas may be used of either normal salt solution or sterile water containing ichthyol, 60 grains to the quart, or ½ of 1 per cent. solution of creolin.

If the signs of intestinal fermentation and putrefaction persist, we may continue these flushings or use a saturated solution of thymol in sterile water. As has been already said, we have no faith in the administration of the so-called intestinal disinfectants by the mouth, nor do astringents given per oram have any better effect, but they do excellent service in catarrh of the lower bowel when used locally by injection. For this purpose after a cleansing enema of warm sterile water we may use injections of silver, as argyrol, ichthyol, or tannic acid (1 gram to 1000 c.c. sterile water). The tenesmus may be relieved by the starch and laudanum low enema, by an opium suppository, or often by a simple saline enema.

If the acute enteritis is caused by parasites of the intestinal canal, it must receive appropriate treatment for the helminthæ, which will be considered in another section.

The constipation which often attends an acute catarrh must be treated with great care; it is rarely wise to give purgatives, as in a few days it will correct itself. If it persists, enemas of olive oil are grateful and efficacious. If it seems to be spasmodic, we may combine opium with the oil.

Secondary catarrhs find their key-note of treatment in their causative factors; that is, a catarrh due to hypostatic congestion from cardiac disease will require cardiac stimulation by digitalis and strychnin, a malarial catarrh will require quinin, and so on.

The dietary of acute catarrhal enteritis should consist of easily digested food taken in small quantities after the total abstinence for from twelve to forty hours. We may start feeding with bouillon, boiled diluted milk, barley and rice, weak tea, and, if the patient is very weak, a little diluted claret or Burgundy may be given. Very cold drinks or water-ices, much craved by the patient, would better be interdicted; so also would beer or fermented drinks better be refrained from. All foods easily fermented in the stomach and intestines must be forbidden. Eggs often come under this class on account of the large amount of decomposable albumin which they contain. Fresh bread, flour preparations, fresh fruit and vegetables, are all to be withheld until the catarrhal inflammation is subdued. We have always withheld the use of carbonated waters in catarrhal diarrhea. We sometimes in the aged allow Apollinaris and claret, but the gas has first been removed by stirring. Cognac may be substituted. As we increase the diet meats may be supplied. Squab and chicken also are acceptable. The light rice and sago puddings, small quantities of cream soups, and stale bread will be allowable, but for many days the patient must eat carefully and sparingly.

CHRONIC CATARRHAL ENTERITIS

The histologic changes consist of the same anatomic conditions that are described as found in acute catarrhal enteritis, but in the chronic variety there is a hyperplasia of connective tissue, and we recognize a hyperplastic and an atrophic form. We will not dwell further upon the pathology, however, but will rather consider the symptomatology and diagnosis, and without a full knowledge of these we cannot treat our cases with intelligence.

Chronic catarrhal enteritis either is a consequence of acute inflammation or is chronic from the start as a secondary catarrh. The symptoms are essentially protean in type. There may be but little disturbance in the nutrition or the emaciation may be extreme. There may be pain or only general abdominal distress; this may be elicited only by pressure or may be constant. Borborygmus and a sense of distention are often experienced.

There is a frequent alternation between constipation and diarrhea.

When the latter exists, from four to six loose stools will occur daily; the stools will have the characteristics already discussed, depending upon the site of the inflammation.

The patients are often irritable, depressed, easily excited, and not infrequently hypochondriacal. The disease is apt to extend over a period of many years, with remissions and exacerbations. It may exhaust the young child and the aged, and death occur from exhaustion.

Hemmeter recognizes four clinical types of the disease, and his classification is so entirely in accord with our experience that we reproduce it as follows:

Type 1.—One evacuation in twenty-four hours. It is mostly unformed, soft, and of the consistency of putty. The diagnosis in these cases is possible by the macroscopic and microscopic examination of the stool and the subjective and objective symptoms.

Type 2.—Here there is the most pronounced constipation. A hard and formed evacuation occurs only once in two to four days. Some require laxatives to secure bowel movement. Mucus will be found in the stools on careful examination.

Type 3.—Several markedly diarrheic evacuations in twenty-four hours, and may show this condition for months. In type 2 the enteritis is limited to a part or the whole of the small intestine; we have an involvement of both the colon and the small intestine in type 3, for in the dejections of this latter type we find the yellow mucous granules seen in acute enteritis, epithelial and round cells, stained by bile, or a diffuse reaction of bile-pigment. Nothnagel explains this diarrhea by an irritation of the inflamed mucosa of the colon by incompletely digested food and the products of fermentation and putrefaction. In this type the peristalsis is permanently increased.

Type 4.—Constipation and diarrhea alternate, or there may be at various times all three conditions—namely, constipation, normal evacuations, and diarrhea. The larger number of cases of chronic enteritis belong to this type. The periodicity of the normal evacuations, constipation, or diarrhea may vary considerably. One or the other condition may exist for days, weeks, and months, before it changes to another condition. The periods of diarrhea are due to accidental conditions which lead to an aggravation of the chronic process. The order of change is often as follows: For two or three consecutive days the patient has normal evacuations; on the fourth day, after premonitory abdominal pains and borborygmi, he will experience from four to eight diarrheic evacuations, which are again followed by constipation. Another order is as follows: For two or three days the patient has daily a very constipated passage; then follow from four to eight days of very soft evacuations with an intimate admixture of mucus, associated with pain and tenesmus. On the following day the patient has constipation, followed by two or three days of very hard stool. These various types may repeat with surprising regularity. The alternation of the condition of dejection is most characteristic of chronic enteritis.

The **treatment** may be considered as hygienic, rest, diet, local treatment if possible, and lastly medicines. The minutest detail of hygiene is extremely important, and nothing may be overlooked, and chilling should at all times be prevented by the use of proper clothing day and night. Rest in a reclining position should be enforced as far as possible, and the amount of exercise allowed must be carefully adjusted to each individual; it should always be short of fatigue. Carefully graded exercise in many of these cases is of extreme value.

The intestine is to be kept clean by irrigation with plain sterile water. If the colon is affected, this is readily done, and the silver salts, boracic acid, and ichthyol may be added to the irrigating fluid. If the disease is higher up, the canal may be cleaned by either of two most valuable drugs—calomel or castor oil. Many prefer the latter; I use the former, if possible.

The Diet.—All foods that ferment easily and those that leave an undigested residue behind, thus causing intestinal irritation, are to be avoided. Food is to be taken in small quantities and at regular intervals; no ice-cold liquids, no sweet drinks.

The patient may take:

Soups: Milk soup, kephir, farina soup, strained oatmeal soup, bouillon with eggs and rice.

Fish: Trout, sole, flounder, bluefish, corvina, barracuda. All fish to be used sparingly. Best broiled.

Meats: Scraped beef or mutton, pounded raw meat, sweetbread, beef-juice.

Eggs: Raw white of egg in water, lightly boiled, poached. (The tendency of yolk of egg to decompose in the intestine and to form the toxalbumin cholin must be remembered.)

Farinaceous Foods: Crackers, toast, macaroni, rice boiled with milk, arrowroot, tapioca, sago, gruel boiled for two or three hours, flour-ball boiled for two or three hours with milk (may add brandy to arrowroot or gruel), purée of potatoes or peas.

Fat: Limited amount of butter only.

Dessert: Milk foods, milk, egg pudding not sweet (flour must be used with caution).

Beverages: Sterilized or pasteurized milk, skim-milk, milk with lime-water, peptonized milk, strong tea, lactic acid water, toast-water, rice-water, koumiss.

Stimulants: Well diluted brandy may be allowed.

The patient must avoid:

Vegetables, soups, new bread, brown and graham bread, oatmeal, fruits, cooked or raw, fried foods, sugary foods, made dishes, nuts, salt meats, veal, pork, fat meats, sausage, pastry, all flour prepared with fat and eggs, most vegetables, cheese, oysters, crabs, lobsters, clams.

Other articles of diet that have been allowed by various authorities are:

When constipation exists in chronic enteritis: kephir, koumiss, and buttermilk, although in our experience the latter is very apt to disagree and cause more distress and irritation. Two days' old kephir will act as a laxative, and four days' old kephir cause some constipation, on account of its contained lactic acid. It is recommended to be taken in doses of half a pint, and to use two quarts in twenty-four hours. Somatose, a mixture of albumoses, if given in doses greater than a teaspoonful, will have a laxative effect; we use it frequently for this effect. We may also allow a few tender vegetables, as spinach, asparagus, and cauliflower.

When diarrhea exists in chronic enteritis: Here the diet must be that which is appropriate to diarrheas, as indicated in the diet table above, but in addition we may select certain preparations containing a relatively large amount of tannic acid, as the Eichelkakao of Liebreich, made by Stollwerk in Cologne, which is simply a mixture of ground acorns in pure chocolate, but it contains about 2 per cent. of tannic acid. Dried huckleberries have also been recommended for the same reason, given as directed. Milk is always of value, and we may disregard the few rare cases where an idiosyncrasy prohibits its use. The milk must be clean and pasteurized. It is now known that dirty milk cannot be sterilized, as toxic changes take place in the milk which sterilizing will not remove. If the taste of milk is distasteful to the patient, as it is to many people, a little tea, coffee, or barley may be added to it, or it may be used with Apollinaris water after the gas has been allowed to escape by stirring.

The *medicinal treatment* of chronic enteritis is of the least importance; most cases will do well if the above details are carefully looked after and few, if any, drugs are administered.

The pain may be relieved by a high colon irrigation, using from 2 to 4 quarts of warm sterile water. This, with rest, and possibly hot applications to the abdomen, will obviate the necessity of administering opium, which is strongly contraindicated in these cases as a routine practice. First remove the foul, stagnating, intestinal contents, and then, if it is necessary to give opium, combine it with a laxative or with calomel, but do not inhibit peristalsis while the intestine contains a decomposed mass of feces, mucus, and other débris. Codein has always seemed to us a much better drug for these patients than morphin.

We have already stated our want of confidence in the so-called antiseptic and antifermentative drugs. We use, however, with considerable satisfaction, calomel, bismuth, and ichthoform; other writers like magnesium salicylate, beta-naphthol, bismuth, and resorcin sublimate. The manufacturing chemists have recently introduced various combinations of barium, as tannigen, tannopin, and tannalbin; they have all been of some use in my work. A combination of bismuth, naphthol, and carbolic acid is a favorite with some.

For directly affecting the inflamed mucous membrane, Wood thinks that the most effective remedy is tar-water mixture, whose formula is:

℞. Picis liquidæ
Triturentur cum liquore calcis
Saturatimem, et percolentur per prunum Virginianam.
S.—Wineglassful one or two hours after meals.

Boas and Jaworski speak well of carbonate and phosphate of calcium, and Hemmeter says that the combination has often checked putrefactive diarrhea in his cases, and that it is very useful in enteritis associated with gastric hyperacidity. The formula is as follows:

℞. Calcium carbonate	25 gm.	(6½ drams)
Calcium phosphate	25 gm.	(6½ drams)
Betanaphthol bismuth	5 gm.	(75 grains)

S.—One teaspoonful three times a day.

Where there is achylia gastrica, dilute HCl may be given after meals in doses of from 10 to 60 drops.

Astringents cannot be considered to be at all curative, and, furthermore, they do a great deal of harm. The old-fashioned pill of nitrate of silver and gentian is no longer in vogue.

We have seen the acid diarrhea mixture of Wood do much good, but it must be cautiously given.

For the pain with profuse stools Hemmeter advises this:

℞. Denarcotized ext. opium	0.2 gm.	(3 grains)
Tannigen	2.6 gm.	(2 scruples)
Bismuth subgallate	4.0 gm.	(1 dram)

M. Cap. No. xii. One capsule thrice daily.

For gastric disturbances with enteritis and loss of appetite, after a test-meal has indicated the amount of HCl to be used, he advises the following combination:

℞. Strychnia sulph	0.02 gm.	(⅓ grain)
Fluidext. condurango	64.00 c.c.	(2 ounces)
Essence of calisaya (P. D. & Co.)	48.00 c.c.	(1½ ounces)
Elixir gentian, enough to make	180.00 c.c.	(6 ounces)

Mis. One tablespoonful thrice daily.

CROUPOUS OR DIPHTHERITIC ENTERITIS

The term diphtheritic enteritis is a heritage from the older medical nomenclature; in our modern phraseology it should correctly be applied only to an intestinal disease caused by the Loeffler bacillus, but the terms croupous and diphtheritic have been retained on account of their macroscopic appearance—that is, a false membrane on the mucosa and deeper layers.

It is true that very rarely true diphtheria produced by the Loeffler bacillus has been seen in the intestines, in the colon, and about the rectum, and has been described by Ssmirnow, Baginsky, and others; but it is such a rare form of enteritis that we shall refrain from further mention of it here. Those who wish to may consult the above papers respectively in "Virchow's Archiv," Bd. cxii, and Nothnagel's "Specielle Pathologie u. Therapie," Bd. ii, "Diphtherie," S. 99. Here I shall confine myself to a diphtheritic or croupous enteritis of the small and large intestine, without the presence of the specific bacillus.

The disease is met in a primary and secondary form. The former occurs as an intractable diarrhea due to hyperplasia and infiltration of the colon, although the small gut is often involved, terminating in ulceration and sloughing of the mucosa in varying degrees, even to perforation of the serous coat. The secondary form occurs during the infectious diseases, pneumonia, pyemia, or typhoid, and later in the more chronic affections, as Bright's disease, cirrhosis of the liver, or malignant growths in the same organ. In certain persons it may follow the administration of mercury, lead, and arsenic.

Stagnating fecal masses may also cause a sloughing enteritis, but notwithstanding the statements of Virchow, Annesley, Trousseau, and others, this must be a very infrequent cause when we remember the great prevalence of constipation and the contrasting rarity of croupous enteritis. We must remember that the intestinal tract is peculiarly prone to ulceration; more so than any other tissue in the human body.

Ulcers are conveniently classified as primary or idiopathic ulcers, and secondary ulcers, concomitants to other diseases. They have been tabulated as follows by Courtois-Suffit (Hemmeter):

(A) Inflammatory ulcerations	Acute and chronic enteritis.		
(B) Specific ulcerations	Typhoid fever, dysentery, anthrax, tuberculosis, syphilis.		
(C) Ulcerations due to interference in the circulation	Embolism and Thrombosis		Ulcerative endocarditis. Purulent infection.
		Arterial Venous	Thrombosis of the Mesenteric vessels.
(D) Ulceration developed from neoplasms	Cancer of the intestines, leukemia, pseudoleukemia, lymphadenoma.		
(E) Ulcerations occurring in amyloid degeneration of the intestines.			
(F) Toxic ulcerations	Arsenic, corrosive sublimate, antimony and potassium tartrate, alcoholism (Bouchard and Brissard, Traité de méd., second edit., p. 483).		

Clinically, Nothnagel has divided them under six subheadings; a classification which is most valuable for clinical study and record, thus:

- I. Ulcerations in consequence of necrobiotic processes.
    1. Simple duodenal ulcer.
    2. Ulcers in consequence of cutaneous burns.
    3. Embolic and thrombotic ulcers; among these are classed the intestinal ulcers peculiar to diffuse neuritis.
    4. Amyloid ulcerations.
- II. Ulcerations due to inflammatory processes.
    1. Catarrhal ulcers.
    2. Follicular ulcers.
    3. Stercoral or decubital ulcers.
- III. Ulcerations in association with acute infectious diseases.
    1. Typhoid or enteric fever.
    2. Dysentery.
    3. Diphtheria.
    4. Anthrax.
    5. Sepsis.
    6. Erysipelas.
    7. Varioloid.
- IV. Ulcerations occurring in chronic infectious diseases.
    1. Tuberculosis.
    2. Syphilis.
- V. Ulcerations occurring in constitutional diseases.
    1. Gout.
    2. Scorbutus.
    3. Leukemia.
- VI. Toxic ulcerations.
    1. Uremic ulcers.
    2. Mercurial ulcers.

The disease may run its course with few or no symptoms and the condition be met with as a surprise at the postmortem table. This has occurred to us several times in the Philadelphia hospitals. Others have an intractable diarrhea, some pain, although pain is not a prominent symptom, rarely tenesmus, but usually pass blood-stained mucus. Especially are the symptoms very slight when the disease arises as a terminal process in some of the constitutional states already described; but in the toxic cases the symptoms are most acute and exacting.

The treatment of croupous or diphtheritic enteritis is identical with that of dysentery, and will be considered with that disease.

PHLEGMONOUS ENTERITIS

Phlegmonous enteritis is an extremely rare disease in its primary form, and it is also but rarely observed in conjunction with intussusception, strangulated hernia, obstruction, carcinoma, and tubercular ulcers. In all probability the diagnosis of phlegmonous enteritis cannot be made before death. Its clinical symptomatology is little known for want of cases to make studies upon.

The treatment need not be considered, as it is hardly probable that a general practitioner will ever meet with it, when we think that Nothnagel's clinic has not the record of a single case. Should a case be met with, its treatment would be that of a grave case of acute enteritis.

DILATATION OF THE COLON AND HYPERTROPHY OF THE COLON

Six varieties of dilatation and hypertrophy of the colon may be seen:

1. A transient gaseous distention, which is not infrequent. This is important clinically, as Fenwick has shown that it may cause sudden heart failure, from pressure on the diaphragm, heart, and lungs.
2. Distention by solid matters, fecal accumulations, gall-stones, new-growths, or foreign bodies.
3. Obstruction of the gut and dilatation above the constriction, commonly seen in malignant tumors and sometimes in volvulus. The distention may become very great and occupy most of the abdomen.
4. Acquired diverticula, as described by Wallman, Hansemann, and others. These are herniated protrusions of the mucosa and serosa with the muscularis absent. They vary in size from very small protrusions to the size of a large orange, and are spherical or cylindrical in shape. They may be present in great numbers; from nine to four hundred have been recorded. They are most frequent in the colon and rectum, but have been seen in all parts of the small intestines. They occur at the site of the transfusion of the mesenteric vessels with the intestinal wall, and are due to pressure upon the wall of the intestine from within or to traction upon the wall from without. Fisher* has shown the intimate relation between the blood-vessels and the tract of these diverticula. His article is most exhaustive, and we learn from it that the pulsion diverticula are most frequently found in the colon, when small protrusions normally exist. They have been attributed to obstinate constipation, to gall-stones, and to stenotic changes in the gut following obstruction. The traction diverticula usually follow localized peritonitis in the gut itself or in adjacent organs. Mesenteric adhesions are also a cause of traction. These acquired diverticula may ulcerate, perforate, and cause peritonitis and death; except for this, they are of little clinical importance.
5. Idiopathic dilatation of the colon is usually seen in children or adults over fifty years of age. In many rachitic children who are constipated a considerable degree of dilatation of the colon often occurs, but it usually regains its normal contour by the fourth year. There is another form, however, which is permanent, and is a congenital hypertrophic dilatation, called by Virchow "giant growth of the colon," also styled megacolon, accompanied by marked muscular hypertrophy, but unaccompanied by distention, unless there may perhaps be some stricture or narrowing at the sigmoid flexure. Valagussa† believes that it is due to an abnormal embryonic evolution, especially in the connective-tissue elements. The muscular hyper-

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* Jour. Exper. Med., vol. v, p. 332.

† Rev. de Clin. Ped., Dec., 1903.

trophy has only in a small degree a functional origin, and consists in myopathy of the fibers. It is not always congenital, nor is it always infantile. It occurs at any time of life and is always of grave import. Mya,* Hirschsprung and Genersich (it is sometimes called Hirschsprung's disease),† Walker and Griffith,‡ and others § have recorded a number of cases in infants. Cases in older children have been recorded by Osler and Hughes and by Stewart and Hand,|| and in a man aged twenty-three at the time of his death by Formad, and in another aged twenty-one by Kredel and in one aged twenty by Hichens.¶

Lunn** records two cases of what he calls idiopathic dilatation of the colon in women of advanced years. There was no evidence of stricture, compression, or fecal accumulation. Bastinnelli's case †† was fifty years of age and MacMuller's a man aged fifty-two. Fitz ‡‡ notes that phantom tumors have been little mentioned in the last few years, but that reports of so-called idiopathic dilatation of the colon are frequently met with. In so far as the latter exhibit a series of characteristics of phantom tumor, when they are seen in elderly women of neurasthenic type, dilatation of the colon should be sought for. He agrees with Treves in recommending operation in these cases.

In the cases that have come to autopsy the dilatation is seen to be enormous, even in the very young. Hughes's boy of three years had a colon 4 inches in diameter which held 14 pints of water. In Formad's man the colon was as large as that of an ox; the circumference was from 15 to 30 inches, and it weighed, with its contents, 47 pounds. In none of the American cases was there stricture at any point, but the mucous membrane had ulcerated and the muscular walls were greatly hypertrophied. It seems to be a fact that ulceration is not usually present; in fact, the mucosa may be normal. The condition is undoubtedly a congenital one. Boys are more often affected than girls, in the proportion of five to one, and Concetti's studies §§ conclusively show that the condition is always congenital. He finds three main anatomic types: (1) Simple excessive length of the colon (Makrocolie; *makros*, "long"); (2) a great uniform increase in the internal diameter of the colon, with thickening of the walls (Megalocolie; *megas*, "great"); (3) simple congenital dilatation of a more or less extensive

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* Lo Sperimentale, 1894, fasc. iii, 215.

† Cf. Jahrb. f. Kinderheilk., Bd. xxxviii.

‡ Am. Jour. Med. Sci., Sept., 1899.

§ Fischer's cases (Pediatrics, May 15, 1901) were infants, six and thirteen months old respectively. Futcher (Johns Hopkins Hosp. Reps., May, 1900) reported the case of a boy four years old in whom improvement followed irrigations. Fenwick (Brit. Med. Jour., Sept. 1, 1900) records the case of a boy seventeen months old; constipation from first week of life obstinate; abdomen tremendously distended; diagnosis made of congenital idiopathic dilatation of colon, confirmed by autopsy. Tittes (Wien. klin. Woch., No. 39, 1901) reported the case of a fifteen months' old boy; Bjorksten (Jahrb. f. Kinderheilk., vol. lv, 1902) that of a girl, three and one-half years of age. The literature contains other cases, but enough have been cited to show the age and sex usually affected.

|| Arch. Pediatrics, March, 1900.

¶ Lancet, Oct. 29, 1898.

** Lancet, May 11, 1899.

†† Ibid.

‡‡ Amer. Jour. Med. Sci., Aug., 1899.

§§ Arch. f. Kinderheilk., B. xxvi, Heft. 7 u 8.

section of the colon, with or without compensatory dilatation of the adjacent section (Ectacolie; *ektatos*, "dilated").

In the first group the long descending colon and sigmoid flexure, having little room in the small pelvis of a child, must make several sharp bends, leading to slowing of the fecal current, accumulation, and all the general disturbances of nutrition set up by the absorption of toxic putrefactive substances; the fecal mass may also irritate the intestine and cause an offensive, watery diarrhea. It is in this group of cases only that medicinal treatment is of any avail. Dietetic management with massage is often very efficacious, for as the child grows the disproportion in the length of the colon lessens, while the abdominal and pelvic cavities become more roomy.

In the second group the activity of the muscularis is interfered with; it atrophies, weakens, and dilatation increases; the new connective tissue involves the walls of the arteries, the mucosa is not nourished properly and easily ulcerates. The chance of life here is not good, although, if the arteries are not extensively involved, the mucosa maintains its nutrition and prevents the absorption of toxic products, and life may be prolonged to twenty-one, twenty-three, or even fifty years.

The third form is identical with that described under the fourth division of our subject—acquired diverticula. These cases live but a few years, the fecal accumulations causing the usual toxemia and ulceration, death resulting often from an acute colitis. So, in all but the first, surgical measures should be taken early.

The symptoms are obstinate constipation and great abdominal distention. The constipation may have existed from early infancy, and the patients may go two weeks without an evacuation. The abdominal distention may entirely disappear for a time after the bowels have been thoroughly moved; it always returns, however, and is so marked as to earn for the Philadelphia case the title of "balloon man." There is usually much emaciation, which seems the more marked when contrasted with the enormous abdomen.

Treves says that the main dangers of idiopathic dilatation of the colon are these: The colon is enormously distended with gas and is tympanitic. The patient suffers from the mechanical effects of distention, particularly shortness of breath, palpitation of the heart, edema of the legs, and, it may be, with albuminuria. The patient may be entirely unable to move, and the face and extremities may be livid, because of the difficulty of breathing. There is marked constipation, and frequently vomiting and hiccough.

Diarrhea may alternate with constipation; in several of Osler's cases the children never had a natural movement. Continued diarrhea is always a serious symptom, and indicates ulceration and putrefaction, and generally leads comparatively soon to death. The abdomen is apt to be soft on palpation, and the peristaltic waves may be visible. Death may occur early in infancy or the patients may reach early or even advanced adult life.

Perhaps some of the obstinate cases of constipation in children may be due to congenital ectasia of the colon of a lesser degree than that described above.

The **treatment** of this form of dilatation is purely surgical. Osler says that good results followed the establishment of an artificial anus in one of his cases, but the ideal procedure is that of Treves,* who removed the diseased tissue, which in his case consisted of the entire descending colon, the sigmoid flexure, and the rectum, with success.

Kredel † suggests the longitudinal invagination of a portion of the intestine throughout the whole extent of the dilatation, although he himself has not done so as yet. If this cannot be done, he suggests the advisability of excising oval portions of the intestinal wall, which he thinks should be done without damaging the mucous membrane and without opening the bowel. In the absence of surgical measures he advises lavage of the colon with large quantities of water or oil. Massage is to be advised with great care; if ulcers are present, it may do a deal of damage.

If obstinate symptoms appear, they should at first be treated medicinally, as they often subside quickly. Forcing air into the rectum may overcome these attacks better than large quantities of water. Severe and persistant diarrhea with prostration demands surgical intervention.

Most cases are treated medicinally, but surgery has the most to offer. If the patient is *in extremis*, we must be content to make an artificial inguinal anus and to do a more radical operation later; but if the patient is in good condition, the indications to resect the gut are clear. The sigmoid may be resected or the ileum may be anastomosed with the upper part of the rectum, with the hope that the colon will atrophy, or we may resect most of the colon, as Treves has done.

Certain it is that every child and most adults who suffer from chronic, obstinate, and persistent constipation, and whose abdomen is habitually distended, should seek surgical advice. In this way the best chances to save life, ease suffering, or effect a radical cure are offered.

In cases of hypertrophy of the colon, the colotomy is a dangerous operation; the mortality is high—eleven deaths in fourteen operations (Mummery). Death occurs from peritonitis, and the postmortem usually shows that leakage has occurred, or the bowel may even have torn away from the abdominal wall, on account of its size, weight, and distention. In a bowel so distended, hypertrophied, and abnormal it is practically impossible to form a spur; hence most writers advise the lumbar route for the performance of the colostomy or colotomy.

In a number of instances colotomy has failed to relieve the symptoms of dilated colon and the artificial anus has not functionated, therefore it is advisable only to do the operation for the relief of symptoms that seem to indicate an immediate fatality.

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* Lancet, Jan. 29, 1898.

† Zeit. f. klin. Med., Bd. liii, Riegel Festschrift.

Resection of the dilated portion of the colon seems now to be the most popular method of treating these cases; its results are the best, notwithstanding the inherent difficulties of the procedure. But unfortunately the dilatation may recur after the resection, and with this knowledge it is wiser to make a wide resection, to prevent redilatation of the remaining portion. If the whole or the most of the colon is dilated, the surgical difficulties of the operation are great, although it has been successfully accomplished, as already stated, by Treves. Lane and others have so operated a number of cases. Most surgeons, however, would prefer a short-circuiting operation, either as a preliminary step to a resection of the colon or as a permanent channel, but ileosigmoidostomy has not proved a success except for temporary relief, unless the dilated loop is resected either at the primary operation or at some subsequent time.

Mummery has obtained good results in dilatation of the colon by performing appendicostomy and keeping the dilated sigmoid empty by daily washings through the appendix.

An attempt to narrow the bowel by Lembert sutures, similar to the operation of gastroplication has proved a failure; so also has fixation of the colon.

There has recently been much discussion as to the value of the colon, and English writers, more particularly, have stated that the race would be better, stronger, and healthier if they possessed no colon at all. The following sentences from Mummery are apropos: "The fact that human beings can live without a colon is no proof of its uselessness, and at present the evidence brought forward to prove that the colon is a useless and effete portion of the alimentary tract is anything but convincing. Under conditions of modern civilization it is undoubtedly possible for human beings to live without a colon, and perhaps even for it not to be missed; but man was not designed to live in a London flat with servants and a banking account, and this can therefore hardly be taken as an argument that the colon is useless."

6. Congenital anomalies in the position, form, and size of the large intestine. The topographic studies made by Curschmann* on congenital anomalies of the large intestine are of extreme clinical interest, and we quote freely from them. Anomalies in the position and size of the cecum and ascending colon may be seen far removed from their usual site, surrounded by small intestine or concealed in the middle of the abdomen.

Loops in the ascending colon are never seen, and but two cases of volvulus are recorded. In other rare cases there is, in addition to the development of the mesentery, an abnormal attachment of the ascending colon to the abdominal wall, corresponding to that existing during a certain period of embryonic life. Such a case occurred under my observation in San Diego, California, in a girl aged fourteen, upon whom I operated for appendicitis. The cecum and appendix and ascending colon were found to be congenitally attached to the abdominal wall; the appendix was immediately beneath the umbilicus and lay in the transverse axis of the abdominal cavity.

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* Deutsch. Arch. f. klin. Med., June 26, 1894.

In all of these cases the cecum and ascending colon are found in the umbilical region, or even to the left of it. Other parts of the intestine are apt to be in an anomalous position. The cecum may be elongated, the elongation being either congenital or acquired. Treves, Leichtenstern, and Eichhorst think that this predisposes to ileus; others do not. Curschmann has often noticed a kinking or bending over of such an elongated cecum. The cecum may be turned upward toward the diaphragm and cause a corresponding protrusion of the ascending colon. In ten of the latter's cases complete obliteration of the bowel was produced, the patients dying with symptoms of ileus. This doubling of the cecum often renders the diagnosis of appendicitis extremely difficult.

An important anomaly is congenital shortening or absence of the ascending colon. This is usually associated with displacement of the cecum and appendix, which may be against the margin of the liver or behind it. The transverse colon and its flexures often depart from the normal. With shortened colon, one or both flexures may be absent. If the right flexure is absent, the ascending colon passes diagonally across to the left side. Absence of the splenic flexure produces the same condition in the descending colon.

A loop may exist in the transverse colon, and rise in front of and overlie the entire anterior surface of the liver; the normal anterior liver dullness is then permanently replaced by a tympanitic note. Enlargement of the flexures with doubling is most common on the left side and can obscure the splenic area. Torsion is less common in the flexures and transverse colon than elsewhere in the large intestine, probably because the links of the loops are usually more widely separated than in the sigmoid flexure.

The descending colon and sigmoid flexure are the most common seats of anomalies of position and size. In a number of cases the sigmoid flexure is unusually long and presents large loops, remains of the fetal condition. The looping is associated with unusual length of the colon; in fifteen cases the colon was from 195 to 228 cm. long, as compared to an average normal length of 142 cm.

A very important anomaly is a loop between the lower end of the sigmoid and the upper end of the rectum, which is usually combined with the entrance of the colon into the right side of the pelvis. Through this the cecum and the loops of bowel are brought into closer relation, and sometimes are united by adhesions in the right iliac fossa.

The large loop in the sigmoid is usually situated in the median line, parallel to and just behind the linea alba, its apex touching the transverse colon, and in some cases even reaching the diaphragm and covering the left lobe of the liver and the stomach. The base of the loop is usually covered by small intestine, an important point in volvulus, as in such cases the existence of parts of the same bowel can be demonstrated in the left iliac fossa or entire left side, and will also first present themselves when the abdomen is first opened.

The constipation which is so frequent in case of enlarged sigmoid depends, at least in part, on two factors—the form of the loop and the lessened effect of the abdominal pressure, and the greater concentration of the feces which is the result of the longer time required for their passage.

ENTEROSPASM OF THE COLON

Recently there has come to be recognized a condition which is due to spasmodic contraction of the circular muscular fibers in some part of the colon. This contraction is very closely localized, and has been seen while the abdomen was open for surgical purposes. The constriction may be from 1 to 4 inches in length. It may be intense and absolute, closing entirely or partly the bowel lumen and producing a train of symptoms that it is often impossible to differentiate from true intestinal obstruction. Writers have compared the condition to asthma and to spasmodic stricture of the urethra. It is usually seen in neurotic women between thirty and fifty years of age, who are hysterical and are probably also the subjects of chronic colitis. It is a very curious condition, and meager as our knowledge is, it is only very recently that we have come to know anything at all positive about it. Here, as in many other instances, it has been the study of the pathology of the living that has supplied the little that we know about it. Again has surgery paid its debt to pathology.

Recently surgeons have opened the abdomen of patients who apparently were suffering from intestinal obstruction, but no obstruction could be found, although the small intestine would be distended and the lower colon collapsed, but at the junction of the collapsed and distended bowel no obstruction could be found. Still more recently several surgeons report having seen such cases, and that during the operation the spasmodic contraction of the colon was actually occurring. The stricture could be both seen and handled, the contraction appearing and disappearing while the colon was actually under observation.

In other instances the tumor will appear only while the intense abdominal pain is present and the symptoms of colitis are marked. An examination between attacks will then fail to demonstrate the presence of a palpable tumor, and repeated examinations under the same conditions will confirm these statements. There will always be localized tenderness over the tumor and the stools during the paroxysm may contain blood. This has been advanced as a reason for stating that enterospasm is always due to colitis, and often to ulcer in the colon. One writer says that in all the cases that he has seen or has found recorded there was blood in the stools—a definite evidence of ulceration somewhere in the bowel as he views it. In the cases that were observed while the abdomen was open a very localized enterospasm would be seen to add evidence to the statement that the spasm is always due to a local irritation, most probably an ulcer; the chronicity of the symptoms also adds to the probability of colonic ulcer being the basal factor in the etiology.

The symptoms of colonic enterospasm are extremely confusing; while they are well marked, their very intensity is misleading. The most marked symptom is of course pain, which arises suddenly without discoverable cause, is paroxysmal, and lasts from a few hours to several days, passing off as suddenly as it arose. The pain occurs in that part of the abdomen in which the contracted colon lies; therefore it may simulate acute intestinal obstruction, renal colic, appendicitis, or peritonitis. Vomiting is often a marked symptom. If the spasm continues, the picture is almost typical of acute intestinal obstruction—a diagnosis that has caused the patient to be submitted to an operation for the relief of that condition. This is a very reasonable error, as, in addition to the subjective symptoms, an examination of the abdomen during an attack may reveal a tumor which is the contracted colon, usually the descending colon or the sigmoid. Sooner or later the spasm relaxes, the bowels move, the pain and all the symptoms subside, and the patient is apparently in a normal state. This happy result is often hastened by the administration of morphin, but in the face of the symptoms as detailed one would not like to give morphin until an honest attempt has been made to clear the diagnosis. In some cases, however, the pain may be too acute to refrain from giving the patient this relief.

As may be gathered, the diagnosis is extremely difficult, and if fecal vomiting and visible peristalsis are present, it is practically impossible. In fact, if cases were not on record where surgeons have seen this spasm actually occurring while the colon was visible during an operation, we would hesitate to classify the disease as a separate entity.

The treatment, if the diagnosis can be made, is simplicity itself, and consists in the administration of morphin, with or without atropin, and the attack terminates very speedily. If we were always certain that we were not dealing with a strangulation of the bowels, cases of enterospasm in the colon could be easily and speedily relieved.

INTESTINAL SAND

Intestinal sand, or *sable intestinale*, is a sand-like material present in the feces, often in considerable amounts—as much as a dram—although one of Mummery's cases passed as much as two ounces a day, an amount that is very unusual. In some subjects of mucous colitis it is always present in the stools in small amounts; in others it is only seen from time to time. Its most frequent association is that with mucous colitis, and when present in large amounts it is said to be the cause of blood in the stools in that disease. True intestinal sand has this composition: Water, 15 per cent.; inorganic matter, 51 per cent.; organic matter, 34 per cent. The residue shows salts of magnesium and calcium; phosphorus, iron, and urobilin. Calcium phosphate is one of the chief constituents, being about 98 per cent. of the total salts.

The origin of this sand is as yet not satisfactorily determined; it would seem to be analogous to the gravel passed in urine. It has been studied by Laboulbene,* Dieulafoy,† Mathieu and Richaud,‡ Fürbringer,§ Eichhorst,‖ Thomson and Ferguson,¶ Duckworth and Garrod,** Mitchell,†† to whom the reader who wishes more detailed information is referred.

The coloring-matter is mainly urobilin, but bile-pigments are also present. Cholesterin is not present, and the sand is not of biliary origin at all. It dissolves in dilute hydrochloric acid, leaving an organic residue in which many bacteria may be found.

False intestinal sand is made up entirely of vegetable débris which is readily demonstrated by microscopic examination, which shows the thick-walled woody cells instead of the crystals of irregular shapes, of brown or yellow tint, which are present in the true sand. The vegetable cells are sometimes encrusted with earthy salts. The passage of either form is often attended by considerable colicky pain, and in mucous colitis the sand may be passed for many months at a time. Mitchell seems to find a relation between the milk diet of the patient and the passage of the sand.

The sand may agglutinate with a mass varying in size from that of a seed to a small nut. Mongour ‡‡ reports such a case in a woman aged thirty-one, an arthritic neurotic, who had suffered for years with digestive disorders and dilated stomach. Later a membranous colitis arose, with colonic pain and pronounced constipation. In addition to the usual membranes, the patient for six or seven months passed small stones. Their discharge would occupy a period of two weeks. On section they were found to be composed of carbonate of calcium and phosphates of magnesium, with organic matter and iron.

The intestinal calculi described by Langanhagen and Schmitt §§ were formed of lime and magnesium which had been administered in cachets. These authors suggest that when bicarbonate of soda, magnesia, and acid bismuth are given in cases of hyperchlorhydria, the acidity of the gastric juice is neutralized by the soda, and other substances remain unchanged and become compressed, hard masses. They further add that the addition of sugar to lime and magnesia forms a soluble compound and may prevent the formation of these calculi.

Duckworth and Garrod state that the fact that urobilin is present in the sand in considerable amounts would seem to show that the sand is probably formed in a region in which bile-pigment has been transformed into urobilin; that is, in the upper region of the colon. The fact that intestinal sand is most frequently associated with mucous colitis would seem to lend strength to this view.

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* Archives. gén. de méd., xxii, 641, 1873; Bull. Acad. Méd. de Paris, ii, 1383, 1893.

† Clin. Méd. de l'Hôtel Dieu, 1896–97, 273.

‡ Bull et Mem. Soc. Méd. des Hôpitaux, xiii, 473, 1896.

§ Verhandlungen des Cong. f. innere Med., xi, 313, 1892.

‖ Deutsches Archiv. f. klin. Med., lxviii, 1, 1900

¶ Journal of Path. and Bact., vi, 334, 1900.

** Medico-Chirurgical Trans., lxxxiv, 389, 1901.

†† Trans. Col. Physicians, Philadelphia, third series, vol. xxv, 1903, p. 152.

‡‡ Compt. rend de la soc. de biol., Feb. 28, 1896.

§§ Gaz. hebdom. de med. et de chir., Feb. 7, 1901.

The **treatment** consists of colonic flushing and that which is appropriate to mucous colitis.

CONSTIPATION

BY JOHN H. MUSSER, M.D., AND GEORGE MORRIS PIERSOL, M.D.

NO clinical symptom is more frequently encountered in the practice of medicine than constipation. The commonplace and obstinate character of the affection is perhaps responsible for the prevalence of the idea that constipation is a necessary evil, rarely capable of permanent cure. As a result, we are prone to look upon the condition with an indifference which allows us to be content with a certain degree of temporary relief, too often brought about by the easiest means at our disposal, namely, the use of purgative drugs. That this attitude is not only erroneous, but often harmful, there can be no doubt. Since constipation is but a symptomatic expression of some underlying disorder, the first step toward its successful management must be the determination of the causal factors, and any treatment, to be efficient, must be directed, not to the temporary improvement of the symptom, but to the permanent removal of the cause. It is evident, therefore, that in any discussion of the treatment of constipation, a consideration of the etiology is of prime importance.

However, an adequate appreciation of the etiologic factors is materially aided by an understanding of the physiology of the mechanism by which normally nature accomplishes the passage of the feces through the bowel.

PHYSIOLOGY

The onward propulsion of the contents of the large intestine is brought about by the peristaltic movements, shown by Bayliss and Starling to consist of wave-like contractions of the intestinal musculature, a wave of contraction being preceded by a wave of relaxation.

The production of these intestinal movements is dependent upon a variety of factors. As in other portions of the intestinal tract, the nerve-supply of the lower bowel is chiefly sympathetic, and includes fibers derived from the neurones of the lumbar and sacral cord segments, and those from the neurones of the inferior mesenteric and subsidiary ganglia, embracing those of the intramuscular plexus of Auerbach within the intestinal wall. The function of the cerebrospinal efferents is excitomotor, while that of the sympathetic neurones proper is probably largely inhibitory.

Although it has been shown that the peristaltic movements of the intestines may occur solely as the result of reflexes, the centers for which probably lie in the nerve-cells of Auerbach's plexus, they may also arise from direct or reflex impulses originating in the central nervous system. Evidence of this is afforded by the marked increase of the colonic movements that are brought about by taking food into the stomach and by the effect of psychic disturbances upon the motor activity of the intestines.

The most powerful local stimuli to intestinal movements are the chemical and mechanical irritations which arise from undigested remains of food, digestive juices, and bacteria. These factors operate largely by causing pressure on the bowel walls by distention, which, as Cannon has shown, is the chief cause of those intestinal movements which bring about segmentation of the bowel contents. It follows, therefore, that those foods which produce the largest amount of undigested residue and at the same time elaborate certain products of digestion, as sugar, organic acids, etc., which act as powerful chemical stimuli to the intestines and also favor the development of bacteria, are the most efficient exciters of the colonic musculature. These requirements are met better by vegetable than by animal foods—a fact which explains the efficiency of a vegetarian diet in certain forms of constipation.

Skiagraphic examinations of patients who have been given bismuth with a meal demonstrate that normally the contents of the intestines begins to reach the cecum between four and five hours after a meal has been taken; two hours later it reaches the hepatic flexure of the colon, nine hours after the meal the splenic flexure is passed, and in eleven hours the contents has descended to the iliac colon. From here on the passage is slower, approximately seven to eight hours being required for the feces to travel from the beginning of the iliac colon to the rectum. The passage of the intestinal contents from the stomach to the rectum requires, therefore, about eighteen to nineteen hours.

The material which passes the ileocecal valve is fluid; as it is slowly propelled along the colons absorption occurs, and the contents becomes progressively less fluid, but remains decidedly soft until its retention in the pelvic colon, where it acquires the firmer consistency of normal feces.

The feces are retained in the pelvic colon until they are forced into the rectum by an increase of colonic peristalsis; the result of direct stimulation from the local irritation and distention produced by a sufficient fecal accumulation in the colon, aided often by reflex stimuli, such as taking food into the stomach, drinking a glass of water or a cup of hot coffee, or the use of tobacco. The increased distention of the rectum produced by the entrance of the feces gives rise to the afferent sensory impulses which are translated into the desire to defecate.

The act of defecation is then accomplished by the voluntary contraction of the abdominal muscles and descent of the diaphragm, by means of which intra-abdominal pressure is raised and more fecal material is forced into the rectum. This produces further distention of the rectum and mechanical irritation of its mucosa, thereby giving rise to afferent impulses which are conveyed to the rectal center in the lumbar cord. From here efferent impulses arise, which cause relaxation of the sphincters, increased colonic peristalsis, and an increase in the contraction of the abdominal muscles, thereby completing the reflex act of defecation. It has been shown that normally during defecation the intestinal tract, from the splenic flexure to the anal canal, is completely emptied.

ETIOLOGY

We may now consider the various pathologic states and functional derangements which are capable of modifying the normal sequence of events just considered in such a way as to bring about a condition of constipation. For clinical purposes it is necessary to discover in detail the causes which produce these disturbances of the physiologic processes. These causal factors are many and varied, and for purposes of classification may be grouped into general and local causes.

The General Causes of Constipation.—Among the general causes may be mentioned:

1. The so-called hereditary or constitutional form of constipation. Several members of the same family sometimes suffer from habitual constipation dating from earliest childhood. It is probably the result of the children of a family not being trained to regular habits.

2. A sedentary life, neglect of the calls of nature, and the habitual or excessive use of purgatives which result in irregular habits, produce constipation by inhibiting or perverting normal stimulation of the intestinal musculature.

3. Dietetic errors are among the most frequent general causes of constipation. These consist in (*a*) an insufficient amount of food and (*b*) food which is deficient in residue. In both instances the bowel is deprived of the mechanical and chemical stimuli necessary to promote proper intestinal activity. (*c*) Finally, even when large amounts of food are taken, overdigestion of food may occur, which results in a decrease in the quantity of intestinal contents to be evacuated.

4. Anemia, certain functional nervous disorders, as neurasthenia and hysteria, and mental diseases, especially melancholia, as well as cachexia from any cause, and acute infectious fevers all tend to produce coprostasis. Such constipation is caused by the atony of the musculature of the bowel resulting from these conditions, aided by the restricted diet commonly prescribed in such diseases. In neurasthenia, melancholia, and allied disorders depression of the nervous system also plays a prominent rôle in the production of constipation.

5. Chronic disease of stomach, heart, kidneys, and liver may secondarily produce constipation by altering the secretions of the alimentary tract and by causing abnormal congestions. In this connection attention should be called to the frequency with which constipation accompanies gastric disorders marked by abnormalities of the gastric acidity, as seen in both hyperacidity and hypoacidity. Many attempts to cure constipation are futile because the states of the mouth and gastric digestion are disregarded.

The Local Causes of Constipation.—These comprise:

1. Weakness of the diaphragm and muscles of the abdominal wall, seen in those whose abdomens have been subjected to overdistention, as from repeated pregnancies, tumors and ascites, and obesity.

2. An important cause of constipation is atony of the intestinal musculature from overstretching of the bowel by gas or feces. Under this head may also be included congenital dilatation of the colon (Hirschsprung's disease).

3. Atrophy of the intestinal mucosa, as encountered in the senile, is also responsible for constipation.

4. Pathologic states of the mucosa of the large bowel, the result of chronic inflammations, which by diminishing the excitability of the intestinal mucous membrane, cause inhibition of the afferent impulses which normally give rise to reflex excitation of intestinal movements, produce constipation.

5. Inhibition of intestinal movements by irritation of the sympathetic nerves, as in the constipation of lead-poisoning, and similar inhibitory impulses produced by sympathetic irritation, the result of various depressing emotions, lead to constipation. Painful impulses, the result of inflammation or trauma of the abdominal and pelvic viscera, may also produce constipation by causing reflexly efferent depresso-motor impulses to be conveyed through the abdominal sympathetic system. The paralyzing action of nicotin upon the sympathetic ganglia probably accounts for the part played by tobacco in aiding evacuation of the bowels in some individuals.

6. Obstruction to the onward movement of the feces is a prominent local cause of constipation. This may arise from abnormally large quantities of feces, but more often from the excessive hardness and dryness of the fecal mass, the result of insufficient ingestion of fluid or excessive absorption or elimination of water from the intestines. Rarely foreign bodies produce a partial or complete obstruction of the bowel. Narrowing of the lumen of the gut by various anatomic and mechanical conditions, such as strangulation, volvulus, and intussusception, strictures and neoplasms, torsions and kinks the result of adhesions and tractions, and extrinsic pressure upon the bowel from tumors, organs, abscesses and bands of adhesions—in short, the causes of acute and chronic intestinal obstruction—result in more or less absolute constipation. Malpositions and deformities of the lower bowel, as seen in the redundant sigmoid and elongated ptosed colon, are prolific sources of constipation.

7. Lastly, spasm of the large intestine may give rise to an obstinate type of constipation, called enterospasm or spasmodic constipation. This condition is met with chiefly in neurasthenic and hysterical women, often the subjects of visceroptosis, but may be encountered as a sequel of chronic ulcerative colitis. Spasm of the sphincter ani, the result of hemorrhoids and fissures, also produces constipation.

In addition, it must be confessed that there exist a considerable number of cases of constipation for which no adequate cause can be assigned and in which the most painstaking search for etiologic factors is fruitless. To this group the undesirable name of idiopathic or habitual constipation has been applied. Even in this group the constipation should be regarded not as a primary condition, but rather as the expression of some abnormal state the exact nature of which is as yet undiscovered.

TREATMENT

From what has been said, it is perhaps unnecessary to further emphasize the fundamental importance of approaching the treatment of constipation from the standpoint of etiology. Since constipation is the result of such devious and often remote causes, treatment based upon the etiology invariably involves patient and painstaking study of each individual case—a fact which probably accounts for the frequency with which this method of management is neglected. Although the removal of the causal factor is essential to the permanent cure of every patient suffering from constipation, there are certain elements of treatment which are more or less applicable to many, if not most, cases of constipation, excluding those in which coprostasis is the result of an organic mechanical obstruction. These fundamental remedial measures may be grouped under the head of physical, dietetic, and medicinal methods.

Physical Methods.—The average individual, as a result of convenience and habit, empties the bowels once in every twenty-four hours. There are, however, many people who normally have two, three, or more bowel movements a day; while others again, in apparently perfect health, may have an evacuation only once in every forty-eight or seventy-two hours. Indeed, there are numerous records of patients who habitually allow a week or more to elapse without having a movement of the bowels and yet experience no inconvenience or ill health. The question as to whether or not a given person is constipated is, therefore, somewhat an individual one. The mere fact that the bowels are not moved daily is not in itself sufficient indication that constipation exists, provided, of course, that when evacuations do occur, they are spontaneous and complete. As a general rule, however, it is safe to assume that under normal circumstances, and on an ordinary mixed diet, the average adult should have the bowels thoroughly emptied once each day.

In the treatment of all forms of chronic constipation, but especially in that variety which has resulted from habitual neglect of the desire to defecate, the establishment of a regular habit of going to stool is of prime importance. As a rule, the most suitable time for a bowel movement is after the morning meal, when there is usually considerable fecal accumulation in the pelvic colon and the ingestion of food and liquid into the empty stomach excites colonic peristalsis. The patient should be instructed to make an effort systematically to have a bowel movement at a fixed hour each morning. Whether or not the desire for a bowel movement is present at this time, is a matter of little moment; the effort should be made just the same. If this course is patiently persisted in, the involuntary muscle of the lower bowel will ultimately become sufficiently trained so that at about the given hour contractions will begin and the desire to defecate will occur. The patient should be told not only to make the effort, but to give sufficient time to it, so that the bowels will have a chance to act. The more frequently the rectum is allowed to become overdistended, the more insensitive becomes the rectal mucous membrane; for that reason patients should also be urged never to neglect any additional desire to defecate that may occur at other times of the day.

Attention should be called to the prophylactic importance of training children in regular habits of defecation. The carelessness or ignorance of mothers and nurses is unfortunately responsible for much habitual constipation. The training should be begun during earliest infancy. As soon as a baby can sit up, the mother should make a practice of placing it upon a suitable vessel at regular intervals during the day. In a surprisingly short time the baby will acquire the habit of having stools at these intervals, and by the time it is eighteen months old, in most instances, a regular habit will have been established. The watchful care of the parent should not end, however, at infancy. During the entire period of childhood vigilance should be exercised over the child, naturally indifferent about such matters, until the daily morning bowel movement becomes as habitual as sleep.

The seed of troublesome constipation in later life is often sown during the school-days. Late rising, an insufficient and often hurried breakfast, and haste to reach school on time, all tend to hinder the proper morning movement. Once in school, the difficulty of leaving the class-room leads to a further disregard to the call of nature. As a result, children previously well trained often reach the end of their school-days seriously constipated. Teachers and parents alike should unite in impressing upon these children the serious consequences of neglecting to have a daily bowel movement, and should coöperate in every way possible to prevent the establishment of careless habits in their charges.

This tendency to neglect defecation is not confined to children, since business and professional men too often allow the press of affairs to interfere with the performance of this most essential physiologic act. Laziness and, in the case of women, false modesty, are often responsible for a disregard of the desire to defecate. Girls in particular should be impressed with the importance of responding to this call, no matter how inopportune the time, or how much preoccupied they may be.

Exercise.– Among the most valuable adjuncts both for the prevention and for the cure of constipation is exercise. The good effect of exercise on constipation is brought about first by its beneficial influence upon the general health, and, secondly, by causing contractions of the diaphragm and of the muscles of the abdominal wall, it stimulates the peristaltic contractions of the intestinal musculature. Although all exercise is helpful, some forms of it are much more valuable in constipation than others. Whenever possible, exercises in the fresh air are preferable, and of the outdoor exercises, horseback-riding, mountain-climbing, rowing, swimming, tennis, and golf are perhaps the most efficient. Quiet walking on the level and bicycle riding have been shown to be much inferior to the above mentioned forms of exertion, in all of which the abdominal muscles are brought into active play. Those who are unable to obtain outdoor exercise may be markedly helped by work in a gymnasium, or better, perhaps, by a course of treatment in a Zander institute. Indeed, there are many patients who derive great benefit from systematically performing simple "setting up" exercises in their own room, night and morning. No matter what the form of indoor exercise, it should be performed with the windows open, so as to insure as much fresh air as possible. For a detailed list of the exercises best adapted to the treatment of constipation, the reader is referred to the article on exercise in volume I of this work.

For those who are physically unable to indulge in active exercise, or as an adjunct to exercise, passive movement, in the form of massage, is of great value. The massage should be largely abdominal, should be mainly directed to stimulation of colonic peristalsis by mechanical irritations, and should be performed only by an expert. Both physicians and patients are prone to forget that to be of value massage must be systematically performed over a long period of time, months often being necessary before noteworthy results are obtained. In patients in whom constipation is but a manifestation of some disease or inflammation of the abdominal or pelvic organs, or in whom so-called enterospasm exists, both exercise and massage are contraindicated.

Hydrotherapy.—For years the value of hydrotherapy has been recognized in the treatment of constipation. Although of itself it can perhaps accomplish but little, in conjunction with other efforts to regulate the bowels and with proper exercise it is undoubtedly of great importance. The simplest and most effective form of hydrotherapy is the cold morning bath, followed by a vigorous rub-down. For those who for any reason are unable to withstand the shock of the cold plunge, various modifications have been devised.

One excellent method is to have the patient stand in a tub in which warm water is ankle deep; then either let the patient sponge the rest of the body with cold water or, better, have an attendant pour cold water down the spine and over the abdomen. If necessary, the water poured over the patient may at first be lukewarm, and on each succeeding day its temperature may be reduced until the patient becomes accustomed to ice-cold water. Cold water, by reason of its stimulating effect upon the intestinal contractions, is decidedly more useful in constipation than warm water. The drip sheet, the cold abdominal compress, and the more elaborate forms of douches, as at present employed in hydrotherapeutic institutes (for a detailed account of which see article on Hydrotherapy, in volume I), are all valuable aids to the treatment of constipation.

Electricity.—As to the value of electricity in the treatment of constipation, opinions are somewhat conflicting. It is safe to assert that of all the physical methods of treatment at our command, it is probably the least useful. The remarkable results sometimes attributed to its use are doubtless due, in part at least, to suggestion. As an accessory to other methods, electricity sometimes is useful. Some authors, including Boas, Obermayer, and Harris, advocate the use of faradism, whereas Hertz, on the other hand, has shown experimentally that the galvanic current is decidedly the more valuable. Electricity finds its chief field of usefulness in cases of constipation due to weak atonic intestinal musculature, and in patients with weak abdominal walls. If the faradic current is used, one electrode should be placed over the spine, while the other is pressed deep into the abdomen and moved along the course of the colon. The galvanic current is usually employed by introducing one electrode into the rectum while the other is moved over the colon.

Dietetic Treatment.—If we eliminate those cases in which constipation occurs in the course of infections, metabolic disorders, or visceral diseases which in themselves require special dietetic measures, certain dietetic regulations may be laid down which, in a general way, are beneficial to nearly all classes of constipated individuals, although more often than not the dietetic management must be supplemented by other forms of treatment.

As has been intimated when referring to the etiology, those forms of constipation which are especially amenable to proper changes in diet include the cases in which too little food is taken. The neurasthenic individual in whom gastro-intestinal symptoms predominate represents this type. Such patients are prone to attribute their subjective symptoms largely to what they eat. In an unguided effort to lessen these symptoms, they frequently become obsessed with the thought that they eat too much; as a result, one article of diet after another is discarded. Sooner or later they attempt to subsist on a diet so meager that not only is their general health markedly impaired, but their previously existing constipation is aggravated, owing to the deficient intestinal residue, which, because of its inability to furnish suitable chemical and mechanical stimuli to the intestinal mucosa, fails to provoke peristaltic waves of proper force.

Other patients are found in whom the diet, though sufficient for the general needs of the organism, is lacking in indigestible residue, as is observed in those who habitually live on a concentrated proteid diet lacking in vegetables and fat. As a consequence products of fermentation, the normal stimuli to peristalsis, are deficient.

A similar condition is brought about in some patients by an over-digestion and excessive absorption of food in the intestines. As a result the intestinal bacteria, deprived of sufficient pabulum, fail to grow and multiply, and in consequence the proper amount of gas, acids, and other stimuli to intestinal activity are not produced. Schmidt and Strassburger, and later Steele, have especially studied this condition, and found that in the stools of constipated individuals of this class the total amount of the bacteria was only about two-thirds as large as normal, and that the feces were noticeably lacking in food remnants.

Steele has also suggested that dietetic changes, incident to modern education and improvement in the art of cooking, have considerably influenced the present-day prevalence of constipation. Increased knowledge as to the digestibility of food, its more scientific preparation and more thorough cooking, together with the use of rolled wheat flour, vegetables canned while young, and cereals well cooked before being put on the market, all tend to make our dietaries more readily assimilable and poorer in residue.

A diet suitable then for constipation must be one which will furnish adequate stimuli to the intestinal mucosa by means of its undigested residue and the various chemical substances elaborated during its digestion. This is best brought about by an increase of cellulose and fat, the increased production of the acids that are the result of bacterial decomposition of carbohydrates, the liberal use of water, a reduction in meat, and the avoidance of all astringents.

Such a diet may be obtained by the use of fibrous vegetables rich in cellulose, as cabbage, Brussels sprouts, tomatoes, mushrooms, lettuce, corn, string beans, onions, cucumbers, and asparagus. Graham or whole wheat bread, rye bread, or pumpernickel should be used in preference to white bread. Bran muffins, made after the following receipt, have been found of value:

BRAN MUFFINS.

Bran flour	2 cups
Wheat flour	2 cups
Sour milk	1 cup
Molasses	4 tablespoonfuls
Soda	2 teaspoonfuls
A little salt.	

Bake in muffin-pans. One to be taken at each meal.

"Quaker Oats," Scotch oatmeal, and the coarser cereals, as corn meal and hominy, are important adjuncts. Fruit, especially juicy varieties, should be eaten freely with each meal, if possible. The best fruits are apples, raw or baked, pears, peaches, plums, cranberries, blackberries, raspberries, currants, grapes, prunes, figs, and dates. All forms of stewed fruit, dried fruit, and preserves, as well as syrups and honey, may be added to the diet with advantage. Butter should be used liberally at every meal, and some advocate the free use of olive oil, to the extent of one to two tablespoonfuls three times a day.

Of the various beverages, coffee, cream, buttermilk, and the various sour milks, cider, carbonated waters, and any form of pure cold water may be used. Of alcoholic drinks, light beer, wine, except red wine, and whisky well diluted may be employed in moderation if indicated. Tea, cocoa, and chocolate are to be avoided. Of all beverages, cold water in generous quantities, especially when taken before breakfast, between meals, and upon retiring, is the most useful. The free use of water is to be especially recommended when constipation is the result of the feces being too hard and dry.

Another substance which may be added to the diet is agar-agar, first recommended by Schmidt. It is non-irritating, quickly increases in bulk when added to water, contains 0.6 per cent. of cellulose, and is passed unchanged by the feces, producing large soft stools. It is best administered by mixing it with other foods.

As in selecting any diet, a suitable one for constipation must be adjusted to the needs of the individual. The idiosyncrasies of the patient must be considered, and those articles which are known to disagree or to lessen intestinal activity should be omitted. This is especially true of milk, which has a most varied effect on different people, in one causing persistent diarrhea, in another producing obstinate constipation. No one diet is applicable to all cases, although the appended diet list, taken from Sutherland, has been found generally useful. Various coexisting conditions of the patient, such as obesity, glycosuria, gout, or a marked gastric disorder, may render a radical revision necessary. For example, diets suitable for gastric hyperacidity or hypoacidity or for dilatation of the stomach will often prove markedly effective in overcoming constipation. In any diet, however, the importance of furnishing the patient with a sufficient quantity of food must not be overlooked.

DIET FOR CONSTIPATION.

Half an hour before breakfast, 10 fluidounces of hot water with a small dose of Carlsbad salt dissolved in it, insufficient to produce an obvious aperient effect; or the juice of an orange made up to 10 ounces with cold water.

Breakfast:
- Coffee with milk and sugar, 10 ounces.
- Graham or whole meal bread or toast, 3 ounces.
- Porridge with milk or cream (2 ounces of Scotch oatmeal).
- One egg (or fish or fat bacon).
- Butter, 1 ounce.
- Honey, ½ ounce (or treacle or home-made marmalade).
- Two apples, baked or raw (or bananas, pears, or other fruit in season).

Lunch:
- Bread or toast as above, 3 ounces (or whole meal biscuits).
- Fish, 2 ounces (or chicken or meat).
- French beans, 4 ounces (or onion, celery, cabbage, or Brussels sprouts).
- Salads with oil, 2 ounces (lettuce, potato, tomato, beet).
- Stewed fruit with cream, 2 ounces (prunes, figs, apple charlotte, or purée).
- Butter, ½ ounce.
- Lager beer, 10 ounces (or cider, Hock, Moselle, Berncastler).

5 P. M.
- Coffee, milk, and sugar, 8 ounces.
- Bread, toast, or whole meal biscuits, as above, 2 ounces.
- Butter, ½ ounce.

Dinner:
- Clear soup, 6 ounces.
- Otherwise as at lunch.

Bedtime:
- Water plain or aërated, 10 ounces.
- Whole meal biscuits.

Medicinal Treatment.—On theoretic grounds, chronic constipation should be managed without the aid of drugs. As a practical proposition, however, this is generally next to impossible. Since it requires time for the physical and dietetic measures to correct constipation, it is desirable, while this is being brought about, that fecal impactions be prevented and the patients spared the discomfort and ill effects of a prolonged period of costiveness. This can generally only be accomplished by the judicious use of drugs.

On the other hand, occasion should here be taken to condemn the habitual use not only of laxatives, but of powerful cathartics, that has become all too prevalent. It has been asserted that among civilized peoples 50 per cent. routinely employ some artificial aid to defecation. Certainly among urban populations this is no exaggeration. This practice is doubtless responsible for much harm, and induces rather than diminishes the incidence of chronic constipation. Not only are those patients who habitually depend upon laxatives less amenable to other forms of treatment, because of the conviction that their bowels require this aid, but the intestine, accustomed to this abnormal irritation, gradually loses its ability to respond to the normal stimuli.

The use of powerful cathartics is not only desirable, but of first importance in many conditions, as during the early stages of acute infections, such as pneumonia, influenza, and the exanthemata; when for any reason it is necessary to increase elimination by the bowel, as in cardio-renal disease, or when the gastro-intestinal tract is the seat of some irritation or is the source of an intoxication. As a routine measure, however, in chronic constipation they have no place.

In this connection a warning should be sounded against the employment of purgatives in constipation which is the result of organic obstruction of the bowel. The writers have more than once seen cases of acute intestinal obstruction come to operation that for days had been vigorously plied with all manner of powerful cathartics, much to the detriment of the patient. Moreover, other cases of partial obstruction have been aggravated in every respect by the same promiscuous use of cathartic drugs. It is safe to say that purgatives of all descriptions are absolutely contraindicated in acute or chronic intestinal obstruction.

To enumerate the vast array of purgatives that have been employed is needless; only those will be discussed that have been found of particular use in the management of chronic constipation.

Among the most useful and at the same time least harmful laxatives stands rhubarb. In small doses it is both stomachic, tonic, and purgative, and does not derange the gastric digestion. It may with advantage be combined with alkalies in the treatment of gastric conditions. It is best given in small doses of 2 to 3 grains of the extract, three times a day after meals; by using small doses the astringent effect of rhubarb is avoided. Another useful method of administering rhubarb is as the pilulæ rhei compositæ, in which 2 grains of rhubarb are combined with 1½ grains of aloes. One or at most two of these pills at bedtime is sufficient to aid in overcoming most moderate constipation.

Aloes has for generations enjoyed a reputation as a laxative in so-called atonic conditions of the bowel. It is alleged to act solely on the large intestine, but in large doses has a tendency to produce rectal irritation and pelvic congestion. An advantage claimed for it is that even when administered over a long period of time it retains its effect.

Under the group of mild laxatives falls rhamnus (cascara sagrada), which at the present time enjoys a wide popularity and forms the basis of a variety of laxative pills. Its use appears not to be followed by any secondary constipation, and the drug is alleged to have a tonic effect upon the bowel. It is frequently administered in the form of the extractum rhamni purshianæ, in doses of 2 to 5 grains, or the fluidextract in doses of 10 minims to two fluidrams. One distinct advantage of the fluid preparation is that the dose may be graduated according to the needs of the patient. It is often advisable to begin with a fairly large dose at bedtime, and then gradually to diminish the dose as the constipation improves, until finally the drug may be entirely discontinued.

A more powerful cathartic than those above mentioned is senna. Its tendency to gripe renders its use alone less common, but in small doses it is used in combination with other drugs to lessen constipation. The most elegant preparation of senna is the confectio sennæ, which has, however, a decided tendency to impair the gastric digestion. A homely method of administration is an infusion of the leaves, which often is mixed with prunes when they are prepared for the table.

Among the newer laxatives phenolphthalein is now much employed, and is said to act largely, if not entirely, on the small intestines. It causes no griping, produces large soft stools, and is perfectly safe in doses of 1½ grains to 5 grains in adults, although it has been pointed out that it is a renal irritant and that its prolonged use is dangerous.

Podophyllum, possibly because of its alleged cholagog action, also enjoys a wide reputation as a laxative. The only preparation that should be used is the resina podophylli, in doses of $\frac{1}{12}$ to $\frac{1}{4}$ grain. It should not be forgotten that large doses of this drug produce toxic symptoms, manifested by violent gastro-intestinal irritation.

A laxative of great value, particularly in children, or when constipation is associated with gastric hyperacidity and a laxative antacid is required, is magnesia. Among the best preparations of magnesia is the milk of magnesia, which may be given in doses varying from 1 fluidram to 1 fluidounce, depending upon the requirements, whereas an almost equally efficient form is the magnesii oxidum ponderosa, given in 5-grain to 15-grain doses one to two hours after meals.

Combinations of several of these laxatives in small doses, with a little belladonna to relieve the griping and the addition of a small dose of strychnin sulphate as a stimulant to the intestinal wall, have become extremely popular, and deserve mention. The following generally useful combinations have been taken from the National Formulary:

Pilula Aloes et Podophylli Compositæ:

Aloes purificatæ	gr. j	0.06
Resinæ podophylli	gr. ss	0.032
Ext. belladonnæ fol. Ext. nucis vomicæ	āā gr. $\frac{1}{4}$	0.016

Pilula Aloini, Strychninæ, et Belladonnæ Comp.:

Aloini	gr. $\frac{1}{5}$	0.013
Strychninæ	gr. $\frac{1}{120}$	0.0005
Ext. belladonnæ fol.	gr. $\frac{1}{8}$	0.008
Ext. rhamni pursh.	gr. ss	0.032

In individuals in whom constipation is associated with a marked muscular atony involving the involuntary intestinal muscles, as well as the skeletal musculature, a drug which has been found to do good, both alone and in combination with some laxative, or when combined with nux vomica, is physostigma. The good effects of this drug in relieving constipation in these atonic conditions depend upon its action as a muscle stimulant. It is said to stimulate muscle structure either by direct action upon the muscle or by stimulating the intramuscular peripheral nerve-endings. As the extractum physostigmatis (gr. $\frac{1}{8}$ to gr. $\frac{1}{4}$) it may be combined in laxative pills, or it may be employed as the tinctura physostigmatis in doses of 10 minims to $\frac{1}{2}$ fluidram, or when rapid action upon the bowel is required, and the stomach is intolerant, it may be given hypodermically in the form of physostigminæ salicylas in $\frac{1}{60}$ to $\frac{1}{30}$ of a grain.

The more drastic purgatives, such as the mercurials, castor oil, jalap, colocynth, elaterium, and the salines, all find a use where prompt relief is desired for an overloaded bowel. Their habitual use should be discountenanced, although occasionally they are distinctly beneficial.

The various saline laxative waters, as Carlsbad, Homburg, Marienbad, Saratoga, Hunyadi, Apenta, etc., have an effect identical with that of the saline cathartics, of which they form a group, depending for their efficiency, as they do mostly, upon magnesium sulphate, sodium phosphate, sodium sulphate, or sodium and potassium tartrate. Their habitual use, therefore, is as undesirable as is that of any other saline. Their chief value is in the relief of constipation due to chronic catarrhal inflammations of the gastro-intestinal or biliary tracts, when they may do good by aiding to remove the cause. There can be no question that the use of these waters at the spas and watering-places where they are obtained is often productive of much good in certain forms of constipation. The beneficial results, however, are doubtless as much attributable to the more hygienic life, the regulation of diet, and proper exercise practised by the patients, as to any peculiar virtues pertaining to the waters themselves.

We have thus enumerated the various drugs from which may be selected the one indicated, in accordance with the character of the bowel movements, the state of the gastro-intestinal tract, as chronic catarrhal enteritis, atony, etc. It is essential in many instances to employ drugs until the habit is conquered, during and after which physical and dietetic measures must be employed. In order to overcome the habit, assuming that the constipation is not the result of systemic disease or obstructive lesion, a systematic procedure must be followed. We have found the adoption of one of the following methods most satisfactory in many cases. The general plan is to find that dose of the remedy selected which will insure one or two free evacuations each day; then systematically, daily or every third or fourth day, reduce the amount of the remedy, and as the habit is controlled, discontinue the use entirely. The time the remedy is given should be that which would insure an evacuation in the morning after breakfast, and this further implies that the patient should conscientiously seek the closet for this purpose, following the observations previously made regarding this feature of a cure.

If a saline and watery evacuant is required, it is best to give it on rising. Any of the usual alkaline laxatives, or combinations of them, may be selected, depending somewhat upon the gastric conditions and the obstinacy of the constipation. Salts of soda in mild and magnesia in severe cases; the former is advisable if there is mild catarrh. For some the citrate of magnesia is preferable, or one of the purgative waters. The dose of the remedy which provokes two movements is obtained; let us say, two teaspoonfuls of Glauber's salts. We might illustrate the procedure by the following directions: Add the required amount, two teaspoonfuls of Glauber's salts, to a glass of water. Take the full amount before breakfast. Continue for five or six days. Then prepare the same quantity, remove one teaspoonful of the solution, and replace with one teaspoonful of plain water. After three days, remove two teaspoonfuls, and replace with equal bulk of water. Follow in three more days by the removal of three teaspoonfuls of solution and replace with same amount of water. In this manner, proceeding cautiously, the solution sooner or later is replaced by pure water. The same procedure can be carried out with the official solution of citrate of magnesia, or with an alkaline purgative water, or a solution of ordinary table salt, having care to give the same bulk of solution while lessening its strength. We may wish to give the preparation cold to the larger number of cases, but in marked mucous gastritis it can be given hot with advantage. The remedy is all the more effectual if it is followed by a little outdoor exercise. As a modification of this in some instances we have plotted out walks in the city which included four or five drug-stores, where a portion of the saline draft could be taken, somewhat after the manner of "cures" abroad. If the patient is not plethoric, or if there are other reasons that watery stools should be avoided, one of the vegetable laxatives should be employed, giving the drug at night. The same method should be adopted. If a pill is given, having secured the efficient dose, in one week reduce it one-eighth; later one-quarter, and so on. If a liquid is selected, as a preparation of cascara, a few drops may be removed at the proper time; but again, for psychic reasons, it should be replaced with the same amount of some other solution, as a simple syrup or colored placebo. It may be wise to reduce the amount very gradually and, in the case of the pill, continue at the same bulk.

At one time it was the vogue to use a selected preparation of turkey rhubarb, chewing a portion two or three times a day, gradually lessening the amount.

Inasmuch as constipation is a frequent attendant of gastric disorders or systemic conditions, the remedy selected for constipation can be combined with the remedies required for the attendant disorder, and after the desired effect is secured, gradually reduced in amount. In this manner magnesia or rhubarb may be combined with intestinal antiseptics or gastric sedatives or stimulants; with iron in anemia; with the bromids or asafetida in the neuroses.

Before dismissing the subject of medicinal measures, attention should be called to the often brilliant results obtained by the management of constipation based upon an investigation of the state of the gastric secretions. This is especially true in cases of hyperacidity, which are, as a rule, accompanied by constipation. The control of the hyperacidity by means of gastric sedatives and antacids, with or without the addition of a mild laxative, such as rhubarb, has time and again been observed to relieve the constipation promptly. The addition of a diet suitable for gastric hyperacidity, and the use of simple exercises and cold bathing, materially aid in relieving not only the primary gastric condition, but also the associated constipation. The same holds true in cases of gastric hypoacidity, which, however, appear more frequently associated with diarrhea than with constipation. In anacidity the use of dilute hydrochloric acid with the meals, preceded by ascending doses of the tincture of nux vomica, has repeatedly accomplished the cure of the constipation.

Enemata.—The use of such local measures as enemata and suppositories may also properly be considered under the head of drug therapy. The continual use of both of these agents is quite as, if not more, detrimental than the routine use of laxatives. The rectum and pelvic colon, becoming accustomed to the abnormal distention and irritation produced by enemata or suppositories, soon cease to respond to the less violent natural stimuli.

Although unsuited for continuous use in the ordinary mild cases of constipation, there are conditions in which enemata are of decided value. They find their chief use in relieving cases of constipation in which accumulations tend to occur in the rectum and pelvic colon, owing to deficient power to expel the feces. In such cases simple soap and water enemata or oil enemata, used systematically, until such time as the bowel regains its normal expulsive power, aid in keeping the rectum and lower colon emptied and prevent its repeated overdistention. When through the other methods of treatment the ability properly to expel has been restored, the enemata should be gradually discontinued.

In cases where it is imperative to empty the lower bowel rapidly in order that cathartics may be employed to better advantage, high compound enemata are of value. A compound enema that has proved efficient may be made as follows:

COMPOUND ENEMA.

Olive oil	f℥iij
Epsom salts	ʒij
Glycerin	f℥j
Spts. turpentine	f℥j
Aq.	q.s. Oj

High enemata of alum, made by dissolving 1 dram of powdered alum in a pint of hot water, will also be found useful at times.

When chronic intestinal obstruction has occurred from a fecal impaction, enemata are of signal service to soften the fecal mass. In such a condition one injection is rarely sufficient, and usually repeated enemata of hot water or warm oil are necessary. The use of these enemata is facilitated by first breaking up the fecal mass, if it can be reached, by mechanical means, as by the gloved finger or by some dull flat instrument.

If there is some temporary loss in the irritability or expulsive power of the rectum, as occurs, for example, from confinement in bed or in acute infections, the glycerin suppository is a convenient and satisfactory means of producing irritation of the rectum and contractions of the bowel. The effectiveness of the glycerin suppository depends both upon the mechanical irritation it produces and upon the chemical stimulation, the outcome of dehydration of the surrounding mucous membrane.

ENTEROSPASM

In the foregoing consideration of the treatment of constipation nothing specific has been said in regard to that type of constipation known as spastic constipation or enterospasm.

Symptoms.—The condition is said to be associated with general nervous irritability, and is generally found in neurotic women, who are subject to spasms elsewhere in the body and are poorly nourished. The condition, however, is by no means confined to females. The abdomen is usually relaxed, and often the firmly contracted descending and iliac portions of the colon may be palpated through the abdominal wall. These patients frequently have a desire to defecate, but the effort not only proves ineffectual, but actually increases the spasm. Some time later the spasm usually relaxes and the bowel is at least partially emptied. The condition is also associated with mucous colitis and catarrhal and ulcerative conditions of the mucosa of the large bowel.

Treatment.—As may be inferred from the symptomatology, the treatment of spasmodic constipation is diametrically opposite to that advocated for most other forms of constipation. All procedures which tend to stimulate the bowel must be avoided, and in their stead efforts to relax the bowel should be employed. Instead of drinking cold water, drafts of hot water are to be preferred. All stimulating hydrotherapy, massage, electricity, and exercise are to be avoided. The best results are obtained by keeping the patient quiet and at rest in bed if possible. The general poor nutrition and lowered state of the nervous system call for an abundance of nourishing, easily digested food. Plenty of sunlight and fresh air, obtained without too much exertion, are of course advisable. The use of 6 to 8 ounces of oil,—a modification of the Kussmaul method,—given high into the bowel once every day, and allowed to remain in the bowel as long as possible, has been found of advantage. The oil should be warm, and the patient should lie on the left side for fifteen minutes, and then on the right side. Warm baths and hot abdominal compresses also help to relieve the enterospasm. Of the drugs recommended, belladonna, because of its tendency to relax spasm, is probably the most useful, although the bromids have also been advocated. Purgatives and mineral waters should be avoided. Opium is generally contraindicated, although in a few cases in which the spasm is the result of an irritation or inflammation, small doses of morphin, or the deodorized tincture of opium, or the former official acetum opii, are said sometimes to be of value.

VISCEROPTOSIS

In the constipation which oftentimes accompanies visceroptosis, as in other forms, the treatment must be directed to the relief of the cause. If the patients are emaciated and atonic, they should receive such forced feeding as the state of their stomachs will allow, and in addition to rest, fresh air, and general tonic treatment, as iron, nux vomica, and physostigma, steps should be taken to remove all accumulations of feces, the bowel being kept well emptied. This is usually best accomplished by colonic irrigations. The local measures directed to the support of the ptosed viscera consist in the proper application of the Rose adhesive plaster belt, or a suitable abdominal binder which actually lifts up the abdomen and does not merely make lateral pressure upon it. In certain selected cases some writers advocate operative procedures. It is pretty well recognized that the cases sent to the surgeon should not be of the primary neuropathic type, as operation is not likely to bring about relief.

INTESTINAL OBSTRUCTION

The management of constipation the result of organic obstruction of the bowel, whether the obstruction is acute or chronic, hardly falls within the scope of this article. The treatment of such conditions is almost exclusively surgical. Upon the medical attendant, however, devolves the responsibility of recognizing these cases in their early stages, of appreciating their gravity, and of promptly seeking the coöperation and advice of his surgical colleague. If this is borne in mind, many cases of carcinoma of the bowel and other forms of intestinal obstruction will be spared a futile course of medicinal treatment and will be afforded early relief at a time when such relief is possible and may be permanent.

INTESTINAL OBSTRUCTION

By John G. Clark, M.D.

Intestinal obstruction is the manifestation of a great variety of pathologic processes, the action of which produces a stasis of the fecal current. Speaking in general terms, the maintenance of the fecal current is dependent upon sufficient propulsive power of the intestinal musculature—*peristalsis*—and upon the integrity of the intestinal lumen. Suspension of the former produces what is termed *paralytic obstruction;* occlusion of the latter, *mechanical obstruction.*

The paralytic form may be: (1) reflex, secondary to some extraneous lesion, such as renal or biliary calculus, torsion of an ovarian cyst, early acute pancreatitis, or injury to the testicle; (2) due to some definite lesion of the intestinal musculature, as in peritonitis, rupture, thrombosis or embolism of the mesenteric vessels; (3) toxic, associated with uremia, pneumonia, and other forms of sepsis. On the other hand, obstruction may be due to an undue spasticity of the intestinal musculature.

Mechanical obstruction may be produced by lesions outside the intestine, as tumors, inflammatory adhesions, congenital bands, peritoneal pouches, and mesenteric slits. Or the obstructing medium may be within the intestine, as benign or malignant strictures and foreign bodies. The intestine may twist upon its own mesentery as an axis-volvulus, or one segment may be invaginated into another—intussusception.

TREATMENT

The reflex type usually yields with the relief of the underlying cause. In those exceptional cases in which treatment is indicated, morphin and atropin are the drugs of greatest service. Eserin salicylate ($\frac{1}{60}$ to $\frac{1}{40}$ of a grain every four hours) is commonly recommended, but in my opinion the drug is of little service, and its depressant action upon the heart may prove harmful. Hot applications in the form of poultices or turpentine stupes or, if these fail, cold by means of the Leiter coil, often prove beneficial. High glycerin, oil, or turpentine enemas and cathartics are useful in stimulating peristalsis.

The treatment of local and diffuse peritonitis has been considered in another section.

Mechanical Obstruction.—Blocking of the fecal current causes not only failure of elimination, but also rapidly increased production and absorption of highly toxic substances, which soon render their host a poor operative risk. Furthermore, as the result of delay in relieving the obstruction, the vascular supply of the intestine may be so impaired as to necessitate procedures which, even under the most favorable circumstances, are associated with a high mortality. Therefore the key-note of successful treatment lies in early, accurate diagnosis, with immediate operation in the majority of cases. When the symptoms point toward obstruction but are insufficiently developed to permit a definite diagnosis, I consider it warrantable to make an exploratory incision, which of itself is practically devoid of danger and may be a life-saving measure.

The definite indications presented for surgical treatment are early removal of the obstructing medium, which in delayed cases may include excision of a gangrenous loop, and evacuation of the poisonous intestinal contents. With the exception of fecal impaction, mechanical obstruction is relieved only by surgical means. Internal medication is then used to hasten the elimination of toxic products and to maintain the function of vital organs, impaired through the action of these toxins. The use of morphin and its derivatives is to be strongly condemned. Cathartics are likewise contraindicated, with the possible exception of those cases refusing immediate operation, under which condition their administration may be advisable to exaggerate the symptoms and thus hasten consent to operation.

Operation.—In the presence of vomiting, lavage is employed immediately prior to operation. The incision is made over the site of obstruction when this can be definitely determined; otherwise the median hypogastric incision offers the best avenue for exploration. The fingers, or if necessary the whole hand, should be introduced, and a gentle, rapid, and systematic search made to determine the location and cause of obstruction. Following up a distended or collapsed coil will often lead quickly to the seat of trouble. The ileocecal and umbilical regions, hernial orifices, and pelvis are the most common sites of obstruction. If intra-abdominal search is futile, time will be saved by allowing the intestines to escape through the incision, which greatly facilitates further manipulations. During this evisceration, the intestines are carefully protected by hot, moist towels. Subsequent procedures depend upon the nature of the obstruction.

Tumors of adjacent organs require excision.

Inflammatory adhesions may be broken up with the fingers or by careful sponging, or may be so dense as to require cutting with knife or scissors. To avoid reformation, the denuded areas must be carefully covered with peritoneum. Long bands are divided between ligatures placed close to the intestine, the intervening portion being excised. The anastomosis of segments proximal and distal to the seat of obstruction is required in those cases presenting dense, multiple adhesions, the separation of which would be impossible.

A Meckel's diverticulum demands excision. After freeing the blind extremity, the proximal end is divided a short distance from the intestine and the stump inverted by a continuous through-and-through linen suture. As an additional safeguard, I use a sero-musculature stitch of catgut. This inversion must not narrow the lumen of the intestine.

Obstruction in a hernia is dealt with according to the technic appropriate to the hernial orifice affected.

Internal Hernia.—If difficulty is encountered in releasing the intestine, the neck of the sac must be enlarged by careful stretching or incision at a point free from blood-vessels. Following reduction, the neck of the sac is narrowed or obliterated by sutures.

Mesenteric Slits.—Not infrequently the opening must be enlarged by stretching or incision at an avascular area before reduction can be accomplished. After releasing the intestine, the rent is closed with a continuous catgut suture.

Intussusception.—Reduction of the intussusception by hydrostatic pressure is to be condemned, because of its frequent failure and danger. The procedure may be used as a measure preliminary to operation in a very early case in which the invagination extends well along the transverse or the descending colon, thus producing a partial reduction before the abdomen is opened, and diminishing intra-abdominal manipulation with its attending shock. Reduction is accomplished, not by pulling on the invaginated bowel, but by progressive upward compression of the intestine distal to the tip of the invagination. Anomalies predisposing to recurrence must be corrected after releasing the invagination: a polypus, tumor, or diverticulum is excised; a long cecum or freely movable ascending colon is fixed to the parietal peritoneum. Intussusception of the small intestine may necessitate shortening of the mesentery by plication, which must be done cautiously to avoid injuring the blood-vessels. Should the intussusception be irreducible, the invaginated portion may be removed through a longitudinal incision in the intussuscipiens or, in chronic cases in which gangrene is unlikely, the whole area may be excluded by a lateral anastomosis. On account of its high mortality, complete excision with end-to-end or lateral anastomosis is advisable only in exceptional cases.

Volvulus.—The sigmoid flexure is the most common site of torsion, although any freely movable portion of the intestine may be affected. The condition is usually secondary to some abnormality, such as an unduly long mesosigmoid, adhesions, or tumor, which must be remedied by appropriate measures to avoid recurrence. A greatly distended loop requires evacuation by incision before uncoiling can be accomplished. The obstruction may be permanently overcome simply by untwisting the bowel; in other cases, however, the twist reforms immediately after reduction. It may be possible by fixation of the bowel to the abdominal wall or by shortening the mesentery to prevent recurrence; if such procedures are futile, excision is necessary.

In any of these forms of obstruction the vitality of intestine may be so impaired as the result of pressure or direct injury to the mesenteric vessels that resection of the gangrenous loop with end-to-end or lateral anastomosis is required. Such a resection should include normal intestine well beyond the area of gangrene.

Strictures.—Excision of the stenosed segment with end-to-end anastomosis is the ideal procedure in both benign and malignant strictures of the small intestine. In the presence of marked distention of the proximal segment, however, excision is dangerous, and must be supplanted by lateral anastomosis with subsequent excision at a second operation in case of malignancy. Tuberculosis may produce single or multiple strictures in the small intestine, or may be localized chiefly to the ileocecal region, producing a tumor which is often difficult to distinguish from carcinoma. If the stricture is single, or if multiple strictures are closely approximated, resection of the whole stricture-bearing segment is advisable; if a considerable length of normal intestine separates the strictures, each one should be treated separately. When the process is localized to the ileocecal region, the diseased area should be excised and the ileum joined to the ascending colon by a lateral anastomosis. The condition of the patient or extensive tuberculous involvement may prohibit excision, under which circumstances the obstruction is overcome by short-circuiting the fecal current—anastomosing loops proximal and distal to the site of the stenosis. Decided improvement in the patient's condition, which frequently follows this procedure, may permit a subsequent resection of the involved area.

Stenosis of the large intestine is due to carcinoma in the great majority of cases. If operable, an excision is performed, including intestine well beyond the growth, especially on its proximal side. Excision of the cecum is followed by an ileocolostomy; excision of other portions of the colon, by an end-to-end anastomosis. Extensive mobilization of the colon may be necessary to permit the easy apposition of the two ends. Should the growth be inoperable, an ileocolostomy or ileosigmoidostomy is required to carry the fecal current around the stenosed segment; inoperable obstruction of the rectum is relieved only by the formation of an artificial anus. Under no circumstances should excision with immediate anastomosis be undertaken when the obstruction is acute, since the intestine above has undergone such alterations as to make the procedure hazardous. The object of the primary operation is limited to the reëstablishment of drainage, which is accomplished by an ileocolostomy or colostomy; after three or four weeks have elapsed, excision with anastomosis may be performed with comparative safety.

Chronic diverticulitis may lead to the formation of a mass indistinguishable macroscopically from a malignant growth. The same general rules detailed for the treatment of operable carcinoma are applicable to this condition.

Fecal Impaction.—A collection in the lower bowel which resists enemas must be broken up with the fingers and evacuated by an oil injection. A high rectal or sigmoidal impaction which injections fail to liberate requires instrumental separation through a proctoscope, with subsequent enemas to bring away the doughy mass. The administration of olive oil in the dose of 2 or 3 ounces four times a day, or saline cathartics and careful abdominal manipulation, may produce the evacuation of a collection in the transverse colon. Purges are dangerous. When, as the result of long standing, the fecal mass is hard and inspissated, ulceration with enterospasm or even partial encapsulation may ensue, under which circumstances other than surgical measures will fail. It may be that intra-abdominal manipulation will succeed in dislodging the accumulation so that it can be passed; should this fail, enterotomy must be performed. Exceptional cases present such extensive ulceration as to demand resection.

Gall-stones and other foreign bodies are removed through an incision in the overlying intestine; if the body can be dislodged, the incision should be made in the dilated portion above to facilitate closure of the intestinal opening.

Thrombosis and Embolism of the Mesenteric Vessels.—It is often impossible to locate definitely the line of demarcation between the affected and unaffected loops; or the process may be progressive, hence resection with anastomosis is unsafe. All that can be done at the primary operation is wide excision of the gangrenous segment, with the formation of a fecal fistula, both ends being sutured to the abdominal wound and drained. To anticipate further extension, the suspected area should be walled off with gauze. After a week or ten days has elapsed the fistula is closed at a second operation.

When the obstruction has existed for any length of time, the intestine above becomes loaded with highly toxic contents, which are evacuated by multiple incisions or, preferably, by the method advised by Moynihan, which consists in carrying off the contents through a large glass tube, inserted into the intestine from below upward. The glass tube is fitted with a long rubber tube which drains into a receptacle. As each segment is evacuated by a "milking process," it is threaded on the tube, the procedure being repeated until the canal is emptied. Following the removal of the tube, the incision in the intestine is closed transversely. When properly performed, no soiling occurs and drainage is unnecessary. It may be possible to avoid opening a distended sigmoid by passing a rectal tube. Following any operation on the large intestine, particularly the descending colon or sigmoid, dilatation of the anal sphincter and insertion of a rectal tube are advisable to facilitate the passage of gas and feces.

The formation of a fecal fistula above the site of constriction is permissible only when the desperate condition of the patient prohibits a more extensive procedure. Should the symptoms be indicative of strangulation, it would be folly to rest content with a fistula; while the obstruction is relieved, the gangrenous intestine quickly leads to peritonitis and death, a sequence which, obviously, the fistula cannot influence. Through a small incision, made under local anesthesia, low down in the inguinal region, a distended loop is picked up and carefully excluded from the abdominal cavity by suturing it to the parietal peritoneum. The intestine is then opened and drained by means of a glass or rubber tube, held in place by a purse-string suture. Later, when the patient's condition permits, a second operation is usually necessary to remove the cause of obstruction and to close the enterostomy opening.

THE SURGICAL TREATMENT OF CONSTIPATION

By John G. Clark, M.D.

Constipation becomes a surgical condition only when the intestine is the seat of some permanent anatomic or pathologic defect which produces a partial obstruction to the evacuation of its contents. The factors instrumental in the production of mechanical constipation are almost invariably situated in the colon, sigmoid, or rectum. By virtue of their fluid state, the contents of the small intestine easily traverse its long, tortuous course, surmounting with ease angulations or constrictions which a more concentrated mass could penetrate only with difficulty; in the large intestine, on the other hand, the feces are rapidly deprived of their watery contents, and assume a semi-solid consistency which renders them especially susceptible to the action of any obstructing medium.

This knowledge of localization must be further supplemented by determining the nature of the abnormality at fault. In addition to those lesions which have been considered under the treatment of intestinal obstruction, mechanical constipation may be due to fissure or fistula in ano, hemorrhoids, stricture of the rectum, and malformations or ptosis of the colon.

Hemorrhoids, fissure, and fistula are commonly associated with constipation, either as the cause or as a result; in either instance the pain and sphincteric spasm incident to these lesions serve to exaggerate the constipation, hence their removal is advisable.

Hemorrhoids.—After a thorough dilatation of the sphincter, the hemorrhoids may be removed by the clamp and cautery, excision of the pile-bearing area, or ligation. I prefer the clamp and cautery, unless a prolapse of the mucosa is present, when an annular excision is performed. In my experience, no untoward results have attended this procedure.

Fissure in ano is cured in the majority of cases by dilatation of the sphincter, combined with cauterization of the base of the ulcer. Exceptional cases resist this simple procedure, necessitating division of the external sphincter.

Fistula in Ano.—The fistulous tract is opened throughout its entire length, including any ramifications which may be present. After the indolent granulation tissue is curetted away, the tract is cauterized and packed with gauze, or the tract may be excised and closed with catgut. The sphincter must be divided at a right angle to the course of its fibers; should more that one division be necessary, the second is performed only after the first has healed.

In all operations about the anus no cathartics are permitted during the preceding twenty-four hours; a simple enema is given the night before operation. In this way the unpleasant passage of feces during operation is obviated. Five days after operation the bowels are moved with castor oil.

Stricture of the Rectum.—An operable malignant stricture requires excision of the rectum by one of the numerous operations devised for this purpose; an inoperable growth with obstruction necessitates the formation of a fecal fistula. The irritating, foul discharge can be greatly lessened by the application of acetone or equal parts of formalin and adrenalin. After injecting olive oil into the rectum, a proctoscope is passed to the site of obstruction and gauze packing saturated with the solution is applied directly to the ulcerating area. A second strip of gauze, impregnated with vaselin or oil, is inserted to keep the first piece in place. The packing is removed in two hours. Morphin is often necessary to relieve the pain caused by these applications. The treatment may be repeated once or twice weekly.

Benign strictures may yield to gradual dilatation by means of bougies which are passed every other day. Should the stricture be situated well up in the rectum, it is first exposed with the proctoscope, through which the dilator is guided into the opening. This procedure must be undertaken with the greatest care and with due regard to the course of the rectum, since the alterations in the rectal wall render perforation comparatively easy. If this method fails, low strictures may be divided by one or more incisions, with subsequent dilatation to prevent recurrence. Internal proctotomy is dangerous when the stricture is above the peritoneal reflection; in this situation excision or recto-sigmoidal anastomosis distal to the area of stenosis will be required.

Ptosis of the Colon.—Before proceeding to treatment, I wish to emphasize the importance of the selection of cases, which determines to a great extent the success or failure of operation. Ready recourse to operation without a careful analysis of each individual case can only result in casting unjust discredit upon operative procedures, which are undoubtedly of distinct service when properly applied.

The symptomatology presented by these cases is characteristic. The patient will have had lifelong constipation, often greatly exaggerated by a protracted illness, child-birth, or injury. Constipation becomes progressively more stubborn, until finally even the strongest cathartics must be frequently repeated to produce an evacuation. Pain in the right or left iliac regions may be sharp or dull and boring in character; the right-sided distress is usually relieved by a bowel movement, while that on the left may be increased. The erect posture almost invariably exaggerated the pain. Excessive peristalsis or "rumbling" is a frequent symptom, which the patient often defines as extending along the course of the colon, and locates definitely the point at which the sensation ceases. Diarrhea with the passage of large quantities of mucus may alternate with constipation. Abdominal distention, relieved by a bowel movement, backache, a constant sensation of weight and dragging in the abdomen, and irritability of the bladder are common symptoms. Completing the picture are symptoms of autointoxication—headache, lassitude, weakness, nervousness, nausea, anorexia, sallow skin, and a secondary anemia. The *x*-ray is of value in confirming the diagnosis; as a standard for operation it is useless.

Before resorting to operation well-directed dietetic, hygienic, physical, and medicinal measures must be given a thorough trial. Further, operation cannot be expected to bring about a marvelous transformation in those individuals who are both mentally and physically lacking in proper development, in whom the colon is but one manifestation of a series of abnormalities. When, however, the symptoms definitely indicate the colon as the chief offender and other measures have failed, operative intervention is indicated.

The exact nature of the operation can be determined only by a careful examination of the colon after the abdomen is opened. Anomalies in peritoneal fusion during the course of development may produce a faulty position of the sigmoid flexure leading to sharp angulation at the junction of the fixed and movable segments; or kinks may be produced by adhesions of congenital origin binding the sigmoid to its own mesentery or to the parietal peritoneum. The normal course of the sigmoid is restored by severing such attachments, followed by sigmoidopexy to prevent reformation. The sigmoid may be dilated, but not sufficiently increased in length to warrant excision, under which circumstances suspension is advisable. A redundant and greatly dilated sigmoid requires partial excision, with end-to-end anastomosis; the opening must be as large as possible in order to guard against subsequent contraction along the line of anastomosis. In a few cases I have inverted the divided ends and performed a lateral anastomosis with excellent results.

The transverse colon may drop into the pelvis before ascending to the splenic flexure, thus producing sharp angulation at its junction with the ascending or descending colon. The splenic flexure is usually present, and in some instances the angulation is exaggerated by adhesions between the opposing segments; the hepatic flexure is variable in its position and may be absent, the transverse colon assuming a tortuous course transversely upward and to the left. These anomalies may be corrected in some cases by suspending the transverse colon to the anterior abdominal wall; in other cases nothing short of resection of the redundant loop, with end-to-end anastomosis, will suffice. It may be necessary to employ both resection and suspension.

The discharge of feces from the ileum may be interfered with by a long, flabby cecum which extends into the pelvis, causing a sharp angulation of the terminal portion of the ileum or at the ileocecal junction. The cecum is restored to its normal position by suspension to the parietal peritoneum.

Such anomalies as have been mentioned may exist singly or in combination; in the latter instance each anomaly requires an appropriate operation for its correction.

Cases are exceptionally encountered in which the distortion of the colon is so extensive as to make the more conservative measures useless. The markedly dilated colon may be supplied with a long mesentery throughout its entire length, which obliterates the splenic and hepatic flexures and permits the intestine to drop into the lower abdomen as a series of conglomerate coils. The weakened musculature and tortuous course are productive of a fecal stasis which further accentuates the difficulties presented. Thus a vicious circle is established which eventually leads to such obstinate constipation that even the strongest cathartics or enemas often fail to produce a satisfactory evacuation.

In the treatment of these exaggerated cases the surgeon is confronted with a problem yet to be solved. In my experience partial excision of the colon, combined with the various forms of suspension, has not met with the success I had formerly anticipated. I am reluctantly coming to the conclusion that these extreme cases must be met by radical measures—complete excision of the colon or ileosigmoidostomy. I cannot urge too strongly against the ready acceptance of this dictum, with hasty recourse to an operation of unknown ultimate results and associated with a considerable primary mortality. The novice has no place in the treatment of these cases; upon the accumulated experience of skilled surgeons must the final solution of this problem depend.

GASTRO-ENTERIC DISEASES OF INFANTS AND CHILDREN

By Maynard Ladd, M.D.

The treatment of the gastro-enteric diseases of infants and children is inseparably connected with the subject of the dietetics of infants (Vol. I). The scope of the present section covers the especial forms of gastric and intestinal disturbance which are peculiar to the period of infancy and early childhood. Diseases such as appendicitis, ulcer of the stomach, proctitis, prolapse, and malformations of developmental origin are not here included.

ACUTE AND CHRONIC GASTRITIS

Gastritis in infants and children is an exceedingly rare disease. It occurs usually from the ingestion of corrosive drugs or other substances of an irritant character, and is not to be confounded with gastric indigestion, or with the vomiting of cerebral or uremic origin or of peritonitis and intestinal obstruction. The treatment consists in thorough lavage of the stomach, starvation for twelve or twenty-four hours, and in other respects does not differ from that to be described under gastric indigestion. If pain is a prominent symptom, it may be relieved by hot applications, or in severe cases by morphin injections. Rectal feeding may be used for several days if the period of starvation is necessarily prolonged.

ACUTE GASTRIC INDIGESTION

An infant who is digesting normally and gaining regularly and at the proper rate may develop an acute gastric indigestion from a number of causes. Whatever the cause, the first indication is to withdraw all food, substituting plain boiled water with from 10 to 20 grains of bicarbonate of soda in each feeding. In the beginning of the attack one or two feedings of water will probably be expelled, but will serve the purpose of washing out the stomach quite as effectively as lavage and with less discomfort. The child should be starved until thirst becomes urgent. This may be in from six to twelve or even twenty-four hours. A very thin barley-water (0.75 per cent. starch) or rice-water or whey may then be begun in small amounts frequently repeated. It should be continued until the stomach has demonstrated its ability to retain fluids.

If the vomiting is associated with diarrhea or fever, calomel or castor oil should be given. Calomel is better borne than castor oil, but the milk of magnesia is better than either, if immediate catharsis is not indicated. Bicarbonate of soda should be continued for twenty-four to forty-eight hours. An infant of one year may be given 60 grains in the course of twenty-four hours. Further medication is unnecessary and is often a means of prolonging the period of gastric irritability. A high enema of soapsuds and glycerin should be given at the beginning of the attack if there has not been a recent normal movement.

The subsequent treatment consists in working the food formula back to its original strength, but very gradually. A simple general rule is to dilute the original formula with barley-water three-fourths the first day, one-half the second day, one-fourth the third day, and then go back to the full strength on the fourth day if there are no contraindications.

In protracted cases stomach washing once a day may be necessary, and the dilution of the food continued for a longer period. Partial peptonization of the milk helps greatly in such cases. As a rule, the fats should be reduced and the alkalinity of the milk increased. If after thirty-six hours no food can be retained in the stomach, rectal feeding with skimmed milk peptonized for one hour must be depended upon to maintain strength. The nutrient enemas may be given at four-hour intervals, five times a day, and containing from 3 to 4 ounces at the age of one year, and from 6 to 8 ounces in the middle period of childhood. In older children egg-albumin, chicken broth, rennet pudding made from skimmed milk, barley and oat jelly, arrowroot, thin cereals, gruels, zwieback, and dry toast with diluted skimmed milk should be the basis of the diet until the regular food can be taken.

CHRONIC GASTRIC INDIGESTION

This condition in infants results, as a rule, from a long period of improper feeding. Its treatment has been considered in connection with the subject of the Dietetics of Infancy (Vol. I). There is no one successful method of restoring the function of digestion. In infants weak mixtures long continued, either whey mixtures, modifications of milk with cereal decoctions, peptonized modifications, malt-soup mixtures, and finally wet-nursing, represent our principal resources for feeding. Bismuth, bicarbonate of soda, and lime-water are the only drugs worthy of mention. Medication, as usually practised, is generally useless and often harmful. Cases which do not yield to food regulation may be greatly benefited by daily lavage of the stomach with a 1 per cent. solution of boric acid or bicarbonate of soda. In fact, lavage is often the only solution to the problem in obstinate cases of chronic vomiting, but there is no condition in which lavage alone is efficient. The adaptation of the food to the individual need of the case must go hand in hand with the stomach washing.

DILATATION OF THE STOMACH

When pyloric stenosis is not a cause, the most frequent factor in producing dilatation of the stomach is overdistention from too large quantities of food. This is especially common in infants who are fed on very weak and highly sweetened foods, such as condensed milk. Improper modifications of milk, causing excessive flatulence, will produce the same result even when the quantity at each feeding is within normal limits. Lavage in these cases is of great help. The quantity of food should be reduced to less than the normal for the average child, the proportion of its ingredients adapted to the state of the digestion, and water should be given freely between the feedings.

In dilatation of the stomach in older children it will be found that the daily ration is from 50 to 100 per cent. more than the actual requirements. The correction of this dietary error alone will usually effect a cure without resort to lavage.

Children in the middle period of childhood are often so terrified by the process of stomach washing that its practice is unwise. So also at the end of the first and in the second year the exhaustion which follows from the mental fright and physical resistance exceeds the benefit of the washing. It is an error to assume the necessity of routine lavage in all cases of chronic gastric indigestion and moderate dilatation of the stomach. A surprisingly large number of infants will recover as rapidly and as well without it by intelligent management of the feeding. In cases in which the feeding alone fails to control the symptoms, the benefit of lavage should be thoroughly tested. Small doses of the tincture of nux vomica and laxatives to maintain the normal bowel function are the only medications called for.

CONGENITAL PYLORIC STENOSIS

The symptoms of congenital pyloric stenosis in infants are dependent upon the two conditions causing obstruction to the outflow of the gastric contents through the pylorus—the congenital thickening of the muscular fiber and connective tissue, and the spasm of the muscle itself. When the closure is complete from hypertrophy of the muscular and connective tissue, the symptoms appear at the very beginning of lactation and progress with great rapidity, giving rise to a definite clinical picture that is easily recognized. Food, irrespective of its composition, is vomited as soon as it is taken, at first easily and then with considerable violence, the vomiting being expulsive in character and the vomitus usually free from bile. The infant cries vigorously from hunger and nurses eagerly and is never satisfied. It loses rapidly in weight and is constipated. In time the stomach becomes dilated, and when distended with food or gas visible and marked peristalsis occurs.

In cases of partial stenosis, in which the spasm of the pylorus is a large factor, the symptoms are less definite. Several feedings may be retained in succession, a certain amount of gastric contents escapes into the duodenum, and the stools are less constipated and larger in bulk. The infant may even gain in weight slowly. During the spasm, however, the vomiting is expulsive in character, and the vomitus may contain bile. Dilatation and visible peristalsis occur, but, as a rule, later than in the cases of complete stenosis. Partial or incomplete stenosis is very difficult to distinguish from gastric indigestion, and can be definitely diagnosed only after most careful observation and management of the feeding.

The treatment of pyloric stenosis becomes a surgical problem as soon as it has been shown that it is impossible to control the vomiting by regulation of the food, and when no progress is being made in the weight development. In the writer's opinion it is usually a waste of time, when the diagnosis is definitely made, to experiment with substitute feeding. Even water cannot be retained except in minute quantities. If the child is breast-fed by the mother, the question of the quality of her milk is always in our mind as the possible cause of the symptoms. The most expeditious way of determining this is to secure at once a wet-nurse, as it will be found easier to regulate the feeding with a disinterested person supplying the breast-milk than to trust to that which is furnished by a nervous and agitated mother.

If the baby can be made to gain in weight upon breast-milk, the question of operation can be indefinitely postponed, and the symptom of vomiting disregarded. In cases of partial stenosis it sometimes happens that enough food is absorbed from the stomach and escapes into the duodenum to cause a slow but steady gain in weight, even in the face of severe and persistent vomiting. In the course of months the growth of the stomach appears to overcome the effects of the congenital defect and a complete cure is effected. The gain in weight is the only sure test as to the safety of postponing surgical intervention. When this gain does not occur, when the infant simply holds its own for several weeks, or when it begins to lose rapidly in weight in spite of intelligent management of the breast-feeding, an operation promises the only chance of life. If this is done early, before the infant has become exhausted from starvation, a very large proportion of operations can be successfully carried out. In convalescence breast-milk should, if possible, be provided for some weeks at least. If this is not practicable, plain whey, and then whey with low percentage of fat and relatively high alkalinity from bicarbonate of soda, should be the basis of the feeding. Many lives are sacrificed by the mistake of considering these infants cases of difficult feeding and by prolonged and useless experimentation with various foods and modifications of milk.

CYCLIC OR PERSISTENT VOMITING

There is a form of vomiting which has been called cyclic or persistent vomiting and which is often mistaken for a severe acute gastric indigestion. It rarely occurs in infants, but is seen most frequently in the middle period of childhood. Its etiology is not clearly understood. It is undoubtedly due to some profound disturbance of metabolism with faulty elimination, resulting in an acute autointoxication. It is associated with the presence of acetone and diacetic acid in the blood and urine. It occurs especially in children of a highly nervous temperament. Overfatigue, fright, or mental excitement frequently precede an attack, but in one who is subject to this disease we may seek without success for the inciting cause, and only too often all means of prophylactic treatment are without results in preventing the recurrence of the attacks. Strictly speaking, it is not a disease of the stomach, and is mentioned only in connection with the symptom of vomiting as seen in children.

The attacks come usually without warning. After the stomach has been emptied of its contents, the vomiting and retching continue, irrespective of food, for from twenty-four hours in mild cases to a week in the severer forms. The peculiar odor of acetone on the breath and the presence of acetone and diacetic acid in the urine at the very outset, or even before the vomiting begins, show the presence of an acute acid intoxication. The cessation of vomiting is abrupt, but the stomach is exceedingly irritable and indiscreet feeding will often precipitate another attack. The recurrences may come at irregular intervals for years, but the tendency is generally outgrown at puberty or before.

The treatment should provide absolute rest to the stomach, maintaining strength by rectal feeding and irrigation, neutralizing the acid condition by bicarbonate of soda, and using sedatives to allay the excessive nervous symptoms.

Too much emphasis cannot be placed upon the uselessness of medication by stomach. Nothing is retained during the vomiting stage. Lavage acts only as further cause of mental excitement and irritation to the stomach, but irrigation of the colon once or twice daily with normal saline solution containing from 1 to 2 drams of bicarbonate of soda is distinctly indicated. It relieves the excessive thirst and encourages elimination of the accumulated toxic substances in the blood and intestines. Not even water or cracked ice should be given by mouth until the child has been free from vomiting for at least twelve hours. Rectal feedings of peptonized skimmed milk and white of egg should be started after the first twenty-four hours. The saline irrigations suffice for the first day. In the nutrient enemas should be put whatever medication is to be used. A good combination is 30 grains of the bicarbonate of soda, 10 grains of sodium bromid, and, if the child is very restless and exhausted from lack of sleep, from 1 to 2 grains of chloral hydrate. This should be incorporated in each nutrient and given at four- to six-hour intervals. The sedatives may be omitted as soon as the vomiting ceases and sleep is possible, but the nutrient with the bicarbonate of soda should be continued for two to three days until the stomach is retaining a sufficient amount of food and liquids to supply the normal action of the bowels and kidneys. Absolute rest in bed, even to the use of the bed-pan, is essential. In extreme cases morphin ($\frac{1}{50}$ grain for one year, $\frac{1}{10}$ grain for eight years) may be given subcutaneously, guarded with strychnin and atropin. The atropin is about one-fifteenth of the dose of morphin.

As soon as the retching ceases a sweet champagne poured over cracked ice is often better borne than plain water. This must be given in teaspoonful doses at frequent intervals, gradually increasing the amount and intervals. Plain boiled water should then be given for several hours, and, if it is retained, peptonized skimmed milk with lime-water is next tried. Ten to 20 grains of glucose three times a day should be given by mouth as soon as the vomiting has stopped.

The loss of weight during an attack often amounts to several pounds. I have found the following gruel most efficacious as a substitute for milk, and one that is generally retained as soon as the child is able to take any nourishment by mouth:

Skimmed milk	16 ounces
Barley water (1.5 per cent. starch)	16 ounces
Malt soup (Loeffland's)	1 ounce

This is cooked in a double boiler for twenty minutes. Beginning with a teaspoonful, the quantity is increased to one-half and then to one ounce at half-hour intervals. When the full quart is taken in twenty-four hours, the strength of the food can be increased by using whole milk in place of skimmed milk and increasing the starch percentage of the barley-water to 3 per cent. (one ounce of barley flour to one pint of water).

Constipation is a natural sequence to the greatly restricted quantity of food which is taken. Laxatives, however, should be strictly avoided in the early days of the attack. The daily use of a cleansing enema preparatory to the rectal feedings is all that is required. If the vomiting recurs after a temporary cessation, it will be necessary to begin again by absolutely withdrawing all liquids by mouth and resuming the nutrient enemas and rectal medication.

In the course of four or five days after the cessation of vomiting the child should be on its regular diet, but it is wise to exclude for a longer time the fats of milk and butter, and to give a relatively larger carbohydrate diet than usual.

Some writers have emphasized the close relation between appendicitis and cyclic vomiting, and still others that between rheumatic fever and cyclic vomiting, and advise prophylactic treatment based upon this supposed etiology. Both conditions should in every case be carefully sought, but, in the opinion of the writer, neither appendicitis nor rheumatic fever, in the great majority of cases, can be shown to be the cause underlying this very complicated affection.

CONSTIPATION

Constipation in infants and young children may prove the simplest or the most difficult of problems. The most important step in its correction is first to determine the etiologic factor, and as the causes are many, one may easily overlook the essential point in the treatment.

The scope of this article does not cover the mechanical and surgical causes of constipation, except to mention them as factors to be excluded in any case. In the new-born, for instance, constipation is rare; its occurrence suggests the possibility of various congenital malformations, such as imperforate anus, atresia, elongated sigmoid, or congenital dilatation of the colon. There is also the constipation occurring at any age, dependent upon an acute intestinal obstruction, the common causes of which are volvulus, strangulated hernia, and intussusception. Chronic intestinal obstruction in various grades of severity may result from fibrous adhesions which are commonly seen in cases of tubercular peritonitis, from fissures, hemorrhoids, polypi, ischiorectal abscesses, prolapse of the rectum and anus, and from simple impaction of feces. With the exception of the latter condition, however, these surgical and mechanical causes of constipation are rare compared with what may be referred to as the medical causes of constipation. They have distinctive associated symptoms which will be readily recognized by an alert physician, and are fully described in the special sections.

Constipation in Breast-fed Infants.—The normal breast-fed infant has from one to four evacuations daily, the number depending largely upon the quality of the breast-milk. Some milks are very laxative and the infant may thrive for months while having six or even more stools daily. The character of the movement more than the number determines the condition of constipation. If the movement is formed, is hard, dry, and granular, and associated with an unusual degree of straining, the infant is constipated whether it has one or four movements daily. The cause is almost invariably to be sought for in the mother. If she is constipated, the baby is likely to be. The fault may lie in any of the many causes of constipation in the adult, such as excessive tea-drinking, lack of exercise and fresh air, irregularity in going to stool, and improper balance of food—habits of life which should be regulated according to the general principles of hygiene and diet.

The special conditions which render breast-milk laxative or not are not thoroughly understood. The natural ferments may play a part, but for practical purposes we are limited to a consideration of the quality of milk as a whole and the various ingredients of which it consists, such as the fats, sugar, and proteids. The normal average breast-milk contains fat from 3.5 to 4 per cent., sugar 7 per cent., proteids 1.5 per cent. The proteids consist of from 0.75 to 1 per cent. whey-proteids, with only 0.75 to 0.5 casein. In constipated breast-fed infants the milk is usually deficient in fats, which may run as low as 1.5 or 2 per cent., and sometimes in sugar, which may be as small as 3 or 4 per cent. High proteids in breast-milk are not commonly a cause of constipation. The indications, therefore, as far as the regulation of the quality of the milk is concerned, are to increase the fat and sugar percentages in the breast-milk. This may be accomplished by increasing in the mother's diet the amount of solid food, such as meat, eggs, and cereals, and adding, with moderation, ale, porter, and stout, and malt extracts and sugars. Babies suffering from constipation from low fats and sugars are likely to show evidences of malnutrition which may be slight, but the gain in weight falls below the normal standard.

Often the milk as a whole is deficient, as may be determined by weighing the baby before and after nursings. In such cases the secretion of milk must be stimulated by the means mentioned and by increasing the quantity of fluids in the mother's diet. When this fails in its purpose, supplementary feeding with a substitute milk, one, two, or three bottles of an appropriate modification, may be all that is required to restore a normal bowel function and so prolong the period of breast nursing.

The treatment as applied to the baby consists in proper regulation of the number of nursings, the intervals and time at each nursing. After the sixth month much can be accomplished in training the child to have a movement at a regular hour. It is generally best to place the baby on the chair before or after its bath. In the beginning, to teach the idea, one may stimulate peristalsis with a small suppository of soap or gluten, but this measure should not be practised as a routine.

Medicinal treatment should be of the simplest. While the question of the feeding is being regulated, milk of magnesia in doses of from one-half to two teaspoonfuls at night is all that is required. When the effort to increase the fat in the mother's milk is only partially successful, a teaspoonful of olive oil may be given to the infant once or twice a day. It is efficacious and a better practice than the giving of cream. After six months orange juice or prune juice may be tried, but in the early months these fruit juices are liable to cause indigestion, and it is wisest to depend upon the milk of magnesia. The stronger laxatives are rarely needed.

Constipation in Infants on Substitute Feeding.—In bottle-fed infants the treatment of constipation is often a difficult problem, as it is complicated with the question of digestion and nutrition. A milk that is modified so as to increase its laxative action may cause a gastric or intestinal indigestion, and we have to face the fact that the material we are using, cow's milk, is in its very nature more constipating than human milk, a difference not wholly dependent upon its gross composition. One cannot approach this phase of the subject without a full understanding of the principles of feeding which have been described in the section on The Dietetics of Infancy (Vol. I).

The fundamental principle of successful infant feeding is to combine with proper intervals and amounts of food a ration which shall have a normal balance of the elements of fats, sugar, and proteids. When these are adapted to the individual requirements of the child, digestion is normal, nutrition progresses according to the laws of growth, and normal bowel function follows as a natural sequence. When the feeding is faulty, digestion is disturbed, nutrition is impaired, and all grades of diarrhea and constipation result.

As in breast-feeding, the causes of constipation may be found in too low fats and sugars and deficient quantity of milk as a whole, resulting in a food deficient in caloric requirements. As a further factor in producing constipation in those whose gastric digestion is vigorous, an excessive amount of fats will produce the same result; for instance, a percentage of 5 or 6. Moreover, in modified cow's milk the proteids consist of from two to three times as much casein as in breast-milk of the same total nitrogen content, and this high casein, especially when combined with low fats, is a combination which results from simple dilutions of whole milk, and undoubtedly has a constipating tendency. In so far as the infant's digestion will permit, the indications are obvious. If the fats and sugars are low, increase the percentages to that of breast-milk. If the daily quantity of food is deficient, adapt the composition of the milk to the digestion of the infant and increase the quantity to that which is appropriate for its age and weight development. Much benefit will also be seen in altering the proteid percentages by the use of whey, so that the proportions of whey proteids and casein will more nearly approach that of human milk. For instance, a total proteid of 1.50 per cent., which in a plain cream mixture contains about 0.38 per cent. whey proteid and 1.12 casein, may be modified so as to contain 0.60 per cent. casein and 0.90 whey proteids.

In the modification of cow's milk, the addition of starch in the form of barley-water serves the purpose of supplying a new element of food for the infant's nutrition and renders the casein more digestible. It may, however, increase the tendency to constipation. This difficulty may be lessened and often entirely corrected by using a malt sugar in place of milk sugar. For this purpose one may use one of the proprietary malt foods or various preparations of malt diastase.

Milk that is pasteurized at high temperature also loses much of its laxative action. For this and other reasons it is advisable to use a raw milk whenever practicable. Many a mother has scrupulously avoided pasteurization or sterilization of milk, on her physician's orders, in preparing the day's supply, but with a curious lack of consistency has failed to appreciate the importance of not overheating the milk when it is warmed just before the nursing. The practical result of her ignorance is that the infant who is supposed to be receiving raw milk is getting it par-boiled.

The custom of reducing the acidity of milk by adding lime-water has proved its merit in innumerable cases of gastric and intestinal indigestion, but it has no place in cases of constipation. If an alkali is needed, it is better to use the milk of magnesia or even the bicarbonate or citrate of soda, the constipating action of which is decidedly less than that of lime-water.

There is little opportunity to correct constipation in bottle-fed babies in the first year by articles of food other than those mentioned. The use of cream to supplement the modified milk should not be employed separately from the milk itself, the fat percentage of which should not exceed 4. If more fats than this are needed, it is better to try olive oil or cod-liver oil, or one of the preparations combining malt and cod-liver oil or malt and olive oil. In cases of constipation with malnutrition the fats mentioned often serve the purpose better than additional percentages of milk fats.

Fruit juices, such as orange juice and prune juice, are useful toward the end of the first year, but in breast-fed infants must always be given with the warning that they may interfere with digestion. If digested, they are moderately efficacious in the mild cases of constipation, but in the obstinate cases can rarely be tolerated in large enough quantities to overcome the constipation. When used, they should always be given an hour before a feeding, when the stomach is presumably empty.

Medicinal Treatment.—The medicinal treatment does not materially differ from that of breast-fed infants. The milk of magnesia generally suffices for the first year. In very obstinate cases the aromatic extract of cascara may be tried. Suppositories are permissible only for occasional use and are in no way curative. Calomel and castor oil are invaluable to obtain a rapid evacuation of the bowels, but should never be used as a routine treatment. Many obstinate cases of constipation have their origin in the frequent use of these much-abused remedies. That they increase the constipation, when the immediate action has ceased, is the common observation of every physician.

Mechanical Treatment.—Enemas of soapsuds and water, alone or combined with olive oil, have their chief indication in emptying the rectum and lower bowel of accumulations of feces, but as a daily measure to produce an evacuation they defeat the object for which one is striving. The regular use of the chair at a fixed hour must be persisted in, even when there is no result. If combined with the other measures advised, it will be a great factor in producing a normal and regular action of the bowels. When all these measures fail, one must resort to massage as directed in the treatment of constipation of older children.

Constipation in Older Children.—In children of more than one year one has many more resources in the way of diet and hygiene to control constipation. In the first place, the possibilities of exercise are greatly increased. The exercise of walking, even in a baby, is a great aid to the development of muscular tone throughout the body, and in older children simple gymnastics designed to strengthen the abdominal muscles may be advantageously carried out. Although the daily airing of these children may be no longer than in the well-cared-for infant, the benefit of the fresh air is greatly enhanced by the more vigorous muscular activities. But by far the most efficient resources are to be found in the greater variety of food which it is practicable to give. After the first year the addition of animal broths, purée of vegetables, eggs, and various forms of bread of a laxative action, become the natural food for the child. After the eighteenth month green vegetables, such as fresh mashed peas, beans, and spinach, are generally well digested and of much benefit. After the fifteenth month thicker and coarser cereals than the barley and oat jelly of the first period are available, such as oatmeal, cornmeal, hominy, wheatena, and cream of wheat, and rice, potato and soft-boiled eggs. The bread may be made of whole wheat and graham flour and spread lightly with butter. At twenty months rare beefsteak, lamb chops, and chicken may be served three times a week, with boiled fresh fish once or twice a week. At this age creamed celery, carrots, cocoa, junket, corn-starch, custard, stewed fruits, apple-sauce, baked apples, scraped new apples, and pears, add considerably to the possibilities of variety of diet. Figs, dates, honey, stewed berries, and raw fruits may be given in the third and fourth year, but are not well borne much before this period.

In the desire to give coarse and laxative foods, which act largely through their mechanical irritation of the intestines, and therefore to stimulate peristalsis, one must guard against the dangers of creating a condition of chronic intestinal indigestion. In cases of difficult digestion some laxative drug may become a necessity, as the bowel function cannot be controlled by the food alone.

Medicinal Treatment.—Of the innumerable laxatives employed, the choice may be narrowed down to milk of magnesia, one of the palatable forms of cascara, phenolphthalein, phosphate of soda, and agar-agar. The dose must be sufficient to produce a soft natural movement and should be continued daily while the diet is being regulated. The drug should be gradually discontinued. The aromatic extract of cascara is given in from 10- to 30-minim doses from one to three times a day. Phenolphthalein is prescribed in chocolate-coated tablets in ¼ to ½ grains one to three times a day. The dose of phosphate of soda varies greatly—20 to 60 grains daily, according to the result obtained. Lately agar-agar has been tried with considerable success. Its chief action is to increase the bulk of the stool, and it is especially indicated in the small, dry stools. The objection to its use in children is the difficulty of getting them to take it. The dose is very variable. For a child of four years 2 teaspoonfuls of the dry flakes, about 1 dram by weight, is an average dose with which to start. The most palatable method of preparation is to boil it for two or three hours until thoroughly homogeneous, then serve it in the broths, or cook it with the cereal.

Massage.—In obstinate forms of constipation no measure succeeds in the end so well as a course of skilled massage. Ordinary rubbing is useless, but daily massage carried out for six to eight weeks, together with the regulation of the food, and the use of drugs until the benefit of the massage has become evident, will usually effect a permanent cure. At the same time the nutrition of the child is greatly stimulated and the general health raised to the normal standard. The massage must be deep and vigorous, rotary in the midabdominal region, and following the course of the colon in the flanks and lower abdomen. The result will fully justify the expense which this treatment involves.

DIARRHEAS OF INFANCY AND CHILDHOOD

Nature and Natural History of the Diarrheas as a Group

The diarrheas occurring in infants represent a variety of conditions which for convenience may be divided into certain definite clinical types showing a decided difference in their symptoms, course, and treatment. This group of diseases has been the subject of very active bacteriologic study, especially in the last five years. The weight of evidence is still strongly against the assumption that all the diarrheas occurring in infants are due to one specific organism. Many factors contribute to their production, such as excessive heat, sudden changes from hot to cold and from cold to hot, improper feeding, contaminated milk, malnutrition from any cause, poor hygiene, impure water and, finally, the action of both saprophytic and pathogenic organisms whose growth is fostered by the conditions mentioned. The so-called "summer diarrheas" do not differ essentially from those occurring at other seasons except that they are more frequent, more severe, and less easily controlled. The term is, therefore, open to objection and should be used only in a very general sense to designate a group of different disorders of the intestines occurring in summer, of which diarrhea is a symptom common to all.

The treatment of the diarrheas in infants should not be the same for all varieties. Some forms are due to mild grades of indigestion, require very simple treatment, and recover without any disturbance of nutrition. Severer forms, which are also of the indigestion type, require more vigorous treatment, but if properly managed the child need not, in a large proportion of cases, lose much in weight or strength. The infectious variety, on the other hand, seriously affects the vitality and nutrition of the child and needs radical treatment. In all these diarrheas the rational treatment is that of the patient rather than of the disease. Routine measures indiscriminately applied often cause unnecessary discomfort and may even delay convalescence. To describe the treatment of these cases intelligently we must adopt some classification. One that is simple and most satisfactory is that adopted by the pediatric department of Harvard University and may be briefly stated as follows:

Acute Nervous Diarrhea.—This is characterized by frequent loose stools of normal color and odor, without abnormal constituents, and by the absence of fever. It is brought about by many different conditions, such as overheating from the high temperatures prevailing in summer, or from overclothing, by sudden changes in the weather, by food that is too rich or too acid, by overexcitement, fright, or exhaustion. It may be a reflex condition symptomatic of some other disturbance, such as difficult dentition, or of acute infectious diseases which are not primarily intestinal. It is simply a manifestation of increased peristalsis, and is not dependent upon any deficient function of digestion. There are no pathologic lesions. If this exciting cause is not corrected, or if the treatment is neglected, the diarrhea may soon develop into one of the more severe types of intestinal indigestion or of infectious diarrhea. If promptly treated, the symptoms quickly subside.

Acute Intestinal Indigestion.—The same causes which give rise to simple nervous diarrhea may, by their continued action or greater severity, produce an attack of acute intestinal indigestion, two distinct clinical varieties of which may be recognized.

(*a*) *Deficient secretion*, characterized by frequent loose movements of normal odor, containing undigested curds, fat, and, often, mucus.

Fever is rarely a symptom or, if present at all, is slight and evanescent. Constitutional symptoms are very mild, although there may be vomiting from reflex gastric indigestion, due either to nervous disturbances or to diminished secretions. This variety differs from simple nervous diarrhea only in the presence of abnormal elements in the stools, such as mucus and undigested food.

(*b*) *Fermental diarrhea,* characterized usually by the initial rise of fever, which subsides in twenty-four or forty-eight hours, and by stools which are frequent, large in amount, loose, often of watery consistency, yellow to green in color, foul or sour in odor, sometimes frothy, and containing small or large amounts of mucus but no blood. The constitutional symptoms may be mild, as in the deficient-secretion type, or severe and associated with vomiting and general malaise. The essential points which lead one to classify it as a form of intestinal indigestion and to separate it from infectious diarrhea are the rapid subsidence of the fever soon after the thorough evacuation and irrigation of the bowel, the rapid improvement in the general condition, and the speedy recovery under appropriate treatment.

In either of these forms of acute intestinal indigestion the bacillus dysenteriæ and many other varieties of micro-organisms may be isolated from the stools, but the weight of evidence goes to prove that the great majority of these cases are not associated with an actual invasion of the intestinal wall. The products of fermentation are doubtless due to the activity of micro-organisms which are for the most part saprophytic. These saprophytes exercise their function more by growth in the material contained within the intestinal canal than in the tissues themselves. It stands to reason that the vulnerability of the intestinal mucous membranes and follicles is greatly increased by such unfavorable conditions, and direct infection may be rapidly engrafted upon a disturbance of digestion which in its origin was purely functional and non-infectious. For this reason it is sometimes difficult to draw a hard and fast line between acute intestinal indigestion and infectious diarrhea. The fermental type is the bridge which connects the indigestion with the infectious classes.

Infectious Diarrhea.—Under this head may be grouped diarrheas which have all the clinical symptoms of the fermental type of indigestion, but which, by their severity and *persistence of fever,* suggest the probability of an acute bacterial infection of the intestinal wall. The diarrheas which are associated with blood in the stools, in addition to the evidence of fermentation and with persistent fever, almost invariably are due to an ileocolitis. The constitutional symptoms in these cases may be as mild as in the simpler types of acute intestinal indigestion, but they are usually characterized by profound constitutional symptoms consisting of high fever, which may be either continued or septic in type, sometimes with marked restlessness or even delirium, pain, and often abdominal distention and tenderness. There is frequently much straining and tenesmus. The movements are often less numerous and smaller in amount than in the acute intestinal indigestion, but there is likely to be considerable mucus and blood, which, like the temperature, persists for from four to five days to several weeks, depending probably upon the virulence of the toxins and the severity of the intestinal lesions. The lesions vary from hyperemia of the mucous membranes and swelling of the follicles to necrosis with ulceration and pseudomembranous inflammation. The clinical symptoms are a very uncertain guide as to the nature of the pathologic alterations. The course and prognosis of the disease depends more upon the virulence of the infecting micro-organism than upon the extent of the lesions, the most rapidly fatal cases often showing the least anatomic changes.

Bacteriologic examinations of the stools show a variety of infections, the largest proportion of which are due to the bacillus dysenteriæ (Shiga bacillus), several strains of which have been isolated, and in almost all the cases agglutinating reactions may be demonstrated in the blood, giving conclusive evidence of the specific nature of the infection. It is, however, by no means certain that the bacillus dysenteriæ when present in the stools is always the sole cause of the diarrhea, for in some cases the agglutination reaction cannot be demonstrated in the blood. There is little doubt that sometimes, although rarely in comparison, other micro-organisms, such as the colon bacillus, the bacillus pyocyaneus, streptococci, and staphylococci, are the chief causes of the diarrhea. It is as yet undetermined how far the symptoms are due to specific toxins and how great a part the multitude of the other micro-organisms, which are always present in the intestinal canal, play in the production of the symptoms and lesions.

Cholera infantum is another condition which is undoubtedly an infectious diarrhea. There is a very acute onset, characterized by severe vomiting, high fever, profuse discharges of a clear rice-water fluid, rapid emaciation, and symptoms of profound collapse. It is a very rare disease, at least in northern latitudes, and is usually fatal in a few hours. Its etiology is still uncertain, as some of the cases which have been examined bacteriologically in reference to their stools have not shown the bacillus dysenteriæ. It is possible that these negative results have been due to the prevalence of the thin watery discharges which do not contain the shreds of mucus in which the bacillus dysenteriæ is generally found.

The essential point in distinguishing between severe forms of intestinal indigestion, especially of the fermental type, and infectious diarrhea is not the presence or absence of blood, but the persistence of fever. Various forms of ileocolitis, such as the follicular and pseudomembranous, may not give rise to bloody stools, but they almost invariably cause persistent fever and run a longer course and are more resistant to treatment than is acute intestinal indigestion. The bacteriologic examination of the stools and of the blood for evidence of specific infections is not always convenient in every-day practice, and an exact diagnosis is, therefore, often impossible. It is safer to treat these cases which show persistent fever with diarrhea as if infectious in origin, even though conclusive evidence is wanting.

THE INDICATIONS FOR AND THE METHOD OF TREATMENT

Climatic Conditions.—The digestion and nutrition of infants, especially in the first year, are in a very unstable stage of development. The depressing effects which even adults may feel from a long-continued period of intense heat, or from moderate heat with great humidity, are still more exhausting to infants. The lowering of the child's general power of resistance first shows itself in a diminished secretion of the gastric and pancreatic juices, and in hypersensitiveness of the whole nervous system. Incomplete digestion of food occurs in consequence, and the intestinal contents thus become a favorable ground for the excessive growth of saprophytic bacteria and, in due time, for the development of pathogenic organisms and direct infection of the walls of the intestinal canal. We thus see the logic, in cases of nervous diarrhea or of mild forms of intestinal indigestion, of reducing the strength of the food so as to bring it within the digestive capacity of the diminished secretions. In the severe forms with fermentation the additional indication of previously ridding the intestinal canal of its abnormal products of digestion by free catharsis at once becomes manifest. The desirability of fresh air and a cooler and more stable climate is also very great, and should be as favorable as is consistent with the means of the family.

Sudden changes in weather from warm to cold may precipitate an attack of diarrhea almost as frequently as a change from cold to hot. For this reason one must exercise most intelligent supervision of the child's clothing and hygiene, and much judgment is required on the part of the mother, and more than can be reasonably expected from the average nursemaid, in seeing that the infant is appropriately dressed. In very hot weather the child should be lightly clad and even kept indoors, if cool, shady places outside are not available. Cold sponging with water, or with equal parts of alcohol and water, at a temperature of 85° or 90° F., and fanning may be profitably resorted to during the hottest hours of the day. Intelligent observation of the baby's condition will often enable a mother to apply these measures in time to ward off the threatened danger.

Feeding in Relation to Prophylaxis.—Less food is needed in very hot days to maintain bodily heat, and the strength should be lessened. This does not mean that a lower standard of feeding should prevail throughout the summer. In ordinary summer weather the healthy infant gains in weight as rapidly as in other seasons of the year, and too prolonged restriction of the diet may greatly retard its normal development. The limitations of the diet should be continued only during the period of excessive temperature. As soon as possible the food should be worked back to the strength which is normal for the child. Boiled water which has been cooled, but not chilled, should be given frequently between the feedings to meet the extra demands put upon the skin and kidneys in the exercise of the excretory functions.

It is of supreme importance in prophylaxis that the food of the infant should be accurately and scientifically adapted to the individual according to the general principles of feeding. These have been considered in detail in the section on The Dietetics of Infancy in volume I. A child who is well fed, gaining normally, and is free from gastric and intestinal indigestion previous to the advent of hot weather will, in the great majority of cases, have enough natural resistance to escape all the dangers of a hot summer, provided the principles of hygiene and feeding are consistently and intelligently carried out by the physician and mother, and that the milk-supply can be kept free from contamination. On the other hand, it is very common to see a baby who has been fed on very irrational and unscientific combinations of food, and who has struggled slowly upward in spite of evidence of mild degrees of indigestion, suddenly develop an alarming diarrhea with the first advent of hot weather. The high mortality among infants from diarrhea in the summer is unquestionably almost wholly among this class of "badly fed" babies who have been reared upon patent foods or unsuitable modifications of cow's milk. There is, therefore, no better prophylactic measure than that which comes from the intelligent feeding of the child in the months preceding the advent of hot weather. This is far more important than a change in climate, desirable as the latter is if the hygienic surroundings are bad. It is, however, surprising to see how many of the most desperate cases of diarrhea in children living in the worst quarters of the city will make a good and rapid recovery in the same environment when the only change is in the substitution of a pure, uncontaminated milk, modified to meet the individual requirements.

The Milk-supply in Reference to Etiology and Prophylaxis.—The greatest source of danger, however, is found in the difficulty of keeping the milk bacteriologically clean, since the continued heat favors the luxuriant growth of all forms of bacterial life. Unremitting vigilance at the farm and in the handling of the milk during and after the modification is necessary to protect the infant from infection from without. Mishaps will occasionally occur in the most carefully regulated establishments, and for this reason it is advisable, as a means of prophylaxis, to pasteurize milk intended for infants in very hot weather, especially in the months of July, August, and September.

The question of the milk-supply transcends all others in importance in the consideration of these cases of diarrhea. A bacteriologic examination of the milk in reference to the number of bacteria present per cubic centimeter is the only reliable method of determining the cleanliness of the milk and its safety for infant feeding. A high grade of milk will run under 10,000 bacteria per c.c.; 30,000 per c.c. is the standard adopted by some milk commissions. Many specimens of milk run from 500,000 to 20,000,000 bacteria per c.c. in midsummer, and it is probable that the administration of such a food plays a very large part in causing the diarrhea. The most careful modification of a dirty milk will prove futile as a means of controlling a diarrhea. Pasteurization and sterilization will not render inert the products of the growth of bacteria.

Withdrawal of Milk and Starvation.—The indications for starvation and the withdrawal of food are simply to provide rest to the function of digestion while the alimentary tract is, by means of cathartics and irrigation, being cleared of its fermented contents. Plain boiled water, or barley-water, given during this period supply the amount of water to the system which is essential to the proper maintenance of the eliminative action of the skin and kidneys. At the very onset of the fever the digestive juices are greatly diminished, and the child shows thirst but not hunger. Milk or any other kind of feeding should, therefore, be postponed until the temperature reacts and begins to decline. This generally occurs within twenty-four or thirty-six hours in the cases of the indigestion type of diarrhea. In infectious diarrhea the temperature may persist for weeks, and in these cases nourishment should be given usually at the end of the second or the beginning of the third day, even if the temperature is elevated. These cases of infectious diarrhea are anatomically cases of ileocolitis, and are not to be subjected to prolonged starvation because of the continued temperature any more than one would starve a case of typhoid fever.

The practice of starvation may be greatly overdone. In the milder forms of diarrhea an infant's vitality is often more seriously injured by the prolonged withdrawal of food than by the diarrhea itself. It is difficult to understand the practice of giving beef-juice, broths, and similar foods, as substitutes for milk, in preference to a clean milk so modified as to represent approximately the same caloric value, especially if the child is of an age in which animal broths would be considered an unsuitable food in a condition of normal health and digestion. Prolonged starvation of itself may so lower an infant's resistance as to become the principal factor in preventing the reëstablishment of normal digestion and nutrition. This is shown by the rapid improvement in symptoms which occurs as soon as cautious but substantial feeding is begun. In general we may state that the greatest trouble is experienced in giving fats and proteids. A food largely farinaceous, with very low fats and proteids, represents the safest feeding with which to start the baby after the initial period of starvation. If a reliable milk-supply is available, milk may advantageously be used to supply the elements of fats and sugar, with cereal decoctions to provide the starch. Such mixtures when cooked as a gruel are often better tolerated than when given raw. In some cases also the malt sugars, in spite of their laxative action, agree better than milk sugar. A reasonable prescription on which to start a baby would, for example, call for 1 per cent. fat, 5 per cent. milk sugar or maltose, 0.50 proteid (or 0.50 whey proteid), and 0.25 per cent. caseinogen, 0.75 per cent. barley starch, with 10 per cent. of the total mixture of lime-water, heated to 212° F. for twenty minutes.

The use of acidified milk, that is, milk inoculated with cultures of lactic-acid bacilli, is strongly recommended by some writers. Such mixtures may prove a valuable food when plain milk modifications are not well borne. The difficulty in using them arises from the dislike to them which is sometimes shown. As the taste is often a cultivated one persistence in their use may be followed by successful results. Even the lactic-acid mixtures should be kept low in the percentages of fats and proteids and are advantageously combined with barley-water. It is better to add the barley-water just before the feeding is given. The subsequent feeding consists in the gradual increase in the percentages of fats and proteids as rapidly as the digestion will allow. In the case of infants it is often three or four weeks, or even longer in the severe cases, before the child is taking the full-strength food. Too much haste in increasing the food will cause the diarrhea again to set in, and one must then begin again as in the original infection. The tendency to increased peristalsis in these cases persists for some time; but if the child is gaining in weight, shows a keen appetite, and is free from fever, one need not be greatly disturbed by the fact that its movements are five or six in number daily. With returning strength the movements become less frequent. It is in this stage of convalescence from acute diarrheas that the mistake is often made of prolonging the period of starvation or under-feeding, with results that are as dangerous to health as the original infection.

Treatment of Acute Nervous Diarrhea.—*Symptomatic Treatment.*—As the symptoms of acute nervous diarrhea are in no way dependent upon fermentation within the intestinal canal or upon infection of the intestinal walls, catharsis, irrigation, and even temporary withdrawal of food, are not indicated. The symptoms are simply a manifestation of increased peristalsis generally brought about by conditions acting through the central nervous system. Rest is, therefore, the first requisite of treatment. In all cases it is wise to limit the child's activities so as to produce as complete rest of mind and body as circumstances permit. The percentage of all the ingredients of the milk should be lowered and the lime-water increased to 10 or 15 per cent. of the total quantity. If the weather is hot, the milk should be pasteurized at a temperature of 155° F. for thirty minutes and its use continued until the stools are of normal number and consistency. Older children who are on a general diet should be put exclusively upon milk, made alkaline with 20 per cent. of lime-water. Drugs are not called for, as a rule. If the diarrhea is due to nervous excitement, bromid of soda may be given for a few doses; if it is accompanied by weakness or prostration, old French brandy in 15- to 30-drop doses, diluted eight times with water, three or four times a day between feedings, is indicated. Reflex gastric irritation is sometimes associated with the diarrhea, and it may be necessary to withdraw all food, except water, for six to twelve hours, and then to begin with a milk considerably weaker than would be required if the intestinal disturbance alone existed.

In extreme cases of nervous diarrhea small doses of paregoric may be safely given. This is, with rare exceptions, the only form of diarrhea occurring in children in which opium is indicated, and even then it should be given very guardedly and for a few doses only, until the excessive peristalsis is under control.

Treatment of Acute Intestinal Indigestion.—(*a*) *Catharsis.*—The treatment of diarrhea of the type described as acute intestinal indigestion is much the same whether of the irritative or fermental variety. The first indication is to rid the intestinal canal of its undigested or fermental contents. This is best accomplished by the administration of calomel or castor oil. The calomel should be given in $\frac{1}{10}$ grain doses combined with 1 grain of bicarbonate of soda, every twenty minutes, for six to eight doses in infants under six months and for ten doses for older children. If castor oil is given, 1 dram for a six-months infant, 2 drams for a child of one to two years, and 4 drams for older children, are the proper amounts to be used. The choice of the laxative is largely a matter of preference. If the stomach is irritable, calomel is generally the better drug to use; if not, one is as efficient as the other. If the calomel does not move the bowels freely, as may happen occasionally, it may be followed by 1 to 2 drams of castor oil.

While catharsis is being carried out no food, except boiled water or barley-water, should be given. In the irritative type of diarrhea intestinal lavage is not usually called for, but in the fermental type the colon should be freely irrigated with salt solution in order to clear it thoroughly of the mucus and undigested food which has been brought down by the calomel or castor oil. It is usually necessary to do this only once, but exceptionally, when the subsequent movements show the presence of considerable amounts of fermented material, the irrigation may profitably be repeated once a day for two or three days, but rarely longer than this.

(*b*) *Irrigation.*—The irrigation is best accomplished by means of a fountain syringe, raised three feet above the level of the bed and containing two quarts of water at a temperature of 105° F., with one dram of salt in solution. A small rectal tube, or the largest size soft-rubber English catheter (No. 14), should be attached to the nozzle and inserted anywhere from 6 to 10 inches. The irrigation should be continued until the water which drains away around the tube runs clear and free from abnormal constituents. It is doubtful if the addition of astringents or antiseptics to the irrigating fluid accomplishes any useful purpose. The bulb or Davidson syringe is much less efficient than the fountain syringe, as the uneven flow of water excites peristalsis prematurely.

(*c*) *Feeding.*—This preliminary treatment need not require more than six to eight hours. If there is no fever, or only a very slight amount, as in simple irritative diarrhea, the intestinal tract is then ready for nourishment. If, as in most cases of fermental diarrhea, fever and general constitutional symptoms exist, the use of boiled water or barley-water should be continued for twenty-four hours, but it is rarely necessary or desirable to prolong the starvation beyond this period. A physician is in many of these cases not called until after the initial symptoms, by which time the fever has fallen and nature has cleared the bowels, as shown by watery movements free from products of fermentation. It may not be necessary then to institute the preliminary treatment described, but one may be able to begin at once with feeding and medication. The character of the stools must be the guide.

Upon resuming the milk feedings one may prescribe with safety very weak modifications of a strongly alkaline pasteurized milk. One will wait in vain for stools to become of normal number, color, and consistency upon a barley decoction which contains practically only 1 per cent. of solid matter. A certain amount of residue is necessary for the formation of normal stools. One should also appreciate the fact that a diarrhea may be aggravated by the exhaustion which is caused by prolonged starvation. Rapid improvement in the character of the movements and either cessation in the loss of weight or immediate gain is often seen with the resumption of feeding carefully and intelligently carried out. The stools are often at first lumpy, but as long as their frequency does not increase and their consistency does not become more fluid and there is no exacerbation of fever and hunger is prominent as a symptom, one need not hesitate to continue the milk feeding and to increase its strength, following the general principles of infant feeding. This course of treatment presupposes one's ability to draw upon an absolutely reliable milk-supply and one's appreciation of the importance of adapting the various proportions of the ingredients of milk to the individual requirements of the infant under treatment.

Plain whey may be used at first and cream gradually added in increasing quantities as fast as the state of digestion permits. It is in our opinion very important to keep the curd or caseinogen at the minimum amount until the stools are almost normal in amount. This is stated in the face of the recommendation of some authorities that it is best to begin with skimmed milk. In our experience, the fats of milk if kept down to 1 or 1.5 per cent. are better tolerated than the proteids (caseinogen) which seem to furnish the saprophytic organisms with the most favorable material for growth. In cases in which gastric indigestion is associated with the diarrhea, the fats must be kept very low, or even excluded, for a longer period than is usually required. If fairly high fat percentages can be digested, as is sometimes true, the gain in weight is much more rapid and convalescence is more speedily established.

The great majority of cases can be started, as soon as the preliminary catharsis and irrigation have been carried out, upon 1 per cent. fat, 0.25 per cent. caseinogen, and 10 per cent. lime-water, with as much whey as can be added in place of the water usually used in making up the mixture. The rapidity with which this combination can be increased in strength up to that which is appropriate for the age of the child when in health depends wholly upon the case. When previous malnutrition and chronic indigestion have existed, as in most of the cases seen in hospital and dispensary practice, the progress is often slow and the most careful feeding must be carried out and the infant kept under close observation for weeks and sometimes months. In previously healthy infants convalescence is rapid.

(*d*) *Control of Excessive Peristalsis.*—Medication in almost all of these cases is important, but it is of the simplest kind. Nine-tenths of the drugs recommended can be dispensed with. The only one of great value is bismuth. By far the best preparation of this for infants and young children is the hydroxid of bismuth, the so-called "milk of bismuth," 1 dram of which is the equivalent of 5 grains of bismuth subnitrate. It is held in permanent suspension. It is tasteless and can be given in a little milk just before each feeding. For an infant of four months 1 dram, for others 2 drams, with each feeding, should be given. If the local conditions are such that the bismuth is not converted into the sulphid within the intestines, with the formation of black stools, one may add 1 or 2 grains of sulphur to each dose of the milk of bismuth. Tannigen or tannalbin in 2-grain doses may be given, in addition, with each feeding when the movements are excessive in number or very watery, but their value is not great. It is, however, often desirable to give from 15 to 30 drops of brandy four times a day, diluted eight times with water between the feedings. The special indication for this is weakness or exhaustion. One cannot say that opium should never be given, but it should rarely be used, and then with extreme caution, and never for the purpose of checking the diarrhea, but only to limit excessive peristalsis.

(*e*) *Change in Air.*—Finally, one should never forget the curative effects of a change of air, especially to a place where the child can be exposed to cool sea breezes, but this is of secondary importance to the necessity of pure milk and intelligent feeding.

Treatment of Infectious Diarrheas.—*Symptomatic Treatment.*—The treatment of acute infectious diarrheas follows in many respects the principles described under acute intestinal indigestion, but there are certain differences dependent upon the fact that one is dealing with an actual infection of the intestinal wall. The cases present all the outward symptoms of intestinal indigestion plus those of a toxemia, the cause of which cannot be so quickly removed by mechanical means.

(*a*) *Catharsis and Irrigation.*—The preliminary catharsis and irrigation should be started at once as described in the treatment of acute intestinal indigestion. The irrigation in severe cases must be continued for a longer period than in the fermental types of diarrhea. The local lesions are a constant source of abnormal elements in the stools, such as blood, mucus, pus, necrotic material, and toxins which nature attempts to eliminate by increased peristalsis. The supplementary action of intestinal irrigation is, therefore, of great importance and should be continued until the stools are comparatively free from blood, mucus, and pus. At the beginning it may be given in the morning and repeated at night for several days. More frequent applications do harm, in increasing rectal irritability. In many cases a single daily injection of salt solution, preferably at night, followed by occasional irrigation when the stools show an accumulation of fetid material, will prove as frequent as needed. Serious mistakes are made by keeping up the treatment week after week until every trace of mucus disappears, for the time invariably comes when the irrigation, instead of acting as a soothing agent, proves an exciting cause of irritation. In such cases improvement in the character of the stools appears at once when intestinal irrigation is omitted.

(*b*) *Regulation of Feeding.*—The question of the withdrawal of food and starvation is somewhat different in infectious diarrheas. If seen at the onset, the child shows profound disinclination toward any kind of nourishment except water, which often persists for days and, in cases of profound toxemia, for weeks, until forced feeding becomes imperative. The child's whims may be favored for forty-eight hours, but beyond that period one should, in the great majority of cases, endeavor to persuade it to take nourishment regularly at two-hour intervals and in small amounts. As the appetite improves the quantity of food should be increased and the intervals lengthened until one has reached that which is approximate for the age. The quality of the food should be determined on the same principles described under intestinal indigestion. In these cases, as in the others, mentioned above, when it comes to the point where food is indicated the patients do as well, if not better, on weak modifications of a pure, strongly alkaline pasteurized milk with the minimum amount of proteids, as on any of the many substitutes suggested.

(*c*) *Fever.*—The persistence of fever requires especial consideration in infectious diarrhea, whereas in intestinal indigestion it is so transitory that it rarely needs attention. The indications for treatment are the same as in typhoid fever. If it is very high and associated with delirium or marked nervous symptoms, it should be reduced by bathing or cold packs. In bathing the water should be warmer than in adults, 90° F. being usually low enough. In infants under one year the temperature of the water should be between 95° and 98° F. Ice-bags to the head should be used with caution, especially in very young infants, in whom they may cause symptoms of depression or even collapse. Sponging with alcohol and water at a temperature of 90° to 95° F. is often a safer procedure than a tub bath or cold pack and can be frequently repeated without exhaustion.

(*d*) *Pain.*—Abdominal pain and tenesmus are frequently troublesome symptoms. Applications to the abdomen of flannels wrung out in hot water or turpentine stupes will give much relief. If the rectal irrigation does not relieve the tenesmus, a cocain suppository containing $\frac{1}{6}$ to $\frac{1}{10}$ grain of cocain, or $\frac{1}{48}$ grain of morphin, for an infant of one year may be inserted in the rectum occasionally, but not as a routine order.

(*e*) *Control of Excessive Peristalsis.*—The use of opium in any form is especially dangerous in the infectious diarrheas, as it tends to check peristalsis and so favors absorption of toxins. If symptoms of collapse set in, due to prolonged drain upon the system from profuse watery movements, radical measures are necessary, and one may then give for an infant of one year $\frac{1}{50}$ grain of morphin sulphate or hydrochlorid subcutaneously, and repeat in an hour. Atropin, $\frac{1}{500}$ to $\frac{1}{800}$ grain given subcutaneously every two or three hours for several doses, is also recommended in these cases of profuse watery diarrhea with prostration, especially in the rare type described as cholera infantum.

Innumerable intestinal antiseptics and astringents have been recommended, and generally too much attention is paid to their use and too little to the rational principles of treatment which have been described in connection with proper hygiene and feeding. The one drug which is undoubtedly of value in infectious diarrheas, as in acute intestinal indigestion, is bismuth. Thirty to 90 grains of bismuth subnitrate is about the amount needed in twenty-four hours; 30 grains for infants under six months, 60 for those one year old, and 90 for older children. The quantity required varies more according to the severity of the diarrhea, as indicated by the number of movements, than to the age of the patient. One teaspoonful of the milk of bismuth is the equivalent of 5 grains of bismuth subnitrate. It is best given just before a feeding mixed with the milk. If, owing to deficiency of hydrogen sulphid in the intestines, it goes through unchanged, its action is greatly lessened. One may then combine with each dose of the bismuth 1 or 2 grains of sulphur, which will cause the bismuth to be converted into the black sulphid, in which form it mechanically coats the inflamed mucous membrane lining the intestines and checks fermentation to some extent. The use of 2 grains of tannigen or tannalbin with each dose of bismuth may be tried when the bismuth alone is not sufficient to check the number of movements. It must be remembered, however, that the course of an infectious diarrhea is that of a prolonged febrile affection, and the character and number of the movements do not become normal until the lesions of the ileocolitis have healed. It is not wise to check the diarrhea suddenly by the use of large doses of medicines. As the symptoms improve and the movements become normal one often sees an occasional stool quite different from the average, containing much mucus and sometimes small amounts of blood. This, if not repeated, does not necessarily indicate an exacerbation of the diarrhea or call for any change in the diet or treatment.

(*f*) *Nervous Symptoms.*—In the treatment of restlessness and malaise one generally depends upon alcohol sponges if the temperature is high, or if not, upon the bromid of soda in 5-grain doses for an infant of one year, or 10 grains for those over two years of age. In extreme cases, in which the simpler remedies fail, one may have to resort to subcutaneous injections of morphin, $\frac{1}{100}$ of a grain for six to twelve months and $\frac{1}{50}$ grain for an infant of one to two years.

(*g*) *Stimulation.*—Cardiac stimulants are required in a large proportion of these cases when the pulse begins to weaken and signs of prostration appear. The first resort is generally alcohol in the form of brandy, 15 minims in 2 drams of water for an infant of one year, 30 minims in half an ounce of water for children of two years. This should be given between feedings and not mixed with the food. When more active stimulation is needed, the subcutaneous use of strychnin, $\frac{1}{200}$ of a grain for a child of six to twelve months, $\frac{1}{100}$ of a grain for one of two to three years, is most effective. Citrate of caffein is even more effective, $\frac{1}{4}$ grain for six months, $\frac{1}{2}$ grain for twelve months. These doses may be repeated two or three times a day. When the stools are very large in amount and of serous character, $\frac{1}{500}$ to $\frac{1}{800}$ of a grain of atropin should be given subcutaneously every three hours for several doses.

Good results are sometimes obtained in such cases by the subcutaneous injection of normal salt solution when the drain upon the tissues has been great. This not only replaces the water in the tissues, but favors the elimination of toxins. In cases of cholera infantum the vomiting and diarrhea are so severe that no alimentation is possible, and the subcutaneous injections of salines and stimulants, with lavage of the stomach and irrigation of the colon, are the only methods of treatment open to us. The removal of the child to the seashore, even when desperately ill, is often the best stimulant and life-saving measure that one can adopt.

(*h*) *Vomiting.*—The treatment of vomiting is primarily rest and occasionally lavage. The vomiting is usually a reflex disturbance and subsides with the appropriate treatment of the diarrhea. When present, the substitution of boiled water or barley-water, or actual starvation, must be continued for a longer time than would otherwise be necessary for the proper treatment of the diarrhea, and when feeding is begun, it must be with weaker modifications of milk. Gastric lavage can be and is greatly overdone. It should not be employed as a routine procedure in every case of infectious diarrhea with vomiting. Some cases are undoubtedly benefited by it, but the number in which it is an essential part of the treatment represents a small percentage of the whole. Its especial indication is in the beginning of an attack of cholera infantum in which there may be an elimination of toxins through the stomach.

(*i*) *Serum Treatment.*—The treatment of infectious diarrheas by the use of serum obtained from animals inoculated with the various strains of the bacillus dysenteriæ has not as yet produced results which lead one to believe that its present state of development has any value as a curative agent.

CHRONIC INFECTIOUS DIARRHEA

Chronic infectious diarrhea, or chronic ileocolitis, is invariably the result of an acute infection, which, because of its severity or neglect, persists for months and results in an extreme degree of malnutrition. The temperature is irregular, at times normal, then subnormal, and subject to sharp rises. The type of indigestion is that described under fermental diarrhea.

The treatment in infants is practically the same as has been fully described under the heading of difficult feeding cases in the section on Dietetics of Infancy (Vol. I). Whenever possible breast-milk should be employed, as substitute feeding is not at once productive of results. The most successful mixtures are likely to be those with low fat percentages, malt sugars, and whey proteids with low percentages of casein. Many desperate cases, seemingly hopeless at the start, have been successfully fed by the writer on the malt-soup mixture described in the treatment of the convalescence from cyclic vomiting. The tendency to scurvy from long-continued use of boiled milk must be borne in mind and counteracted by small daily doses of orange juice. Irrigation of the colon is of little use in these cases. In older children scraped beef, white of egg, junket, and zwieback may supplement the malt-soup mixture. Nux vomica and the citrate of iron and quinin are useful as tonics.

MUCOUS COLITIS

Mucous colitis is a very rare disease in infancy and early childhood. It may, however, occur in children of a highly neurotic tendency. It seldom, if ever, is preceded by an acute infectious diarrhea. Constipation of long duration is far more likely as an antecedent condition than diarrhea. With the dejections large masses of mucus or "ropy" material are passed at irregular intervals, sometimes forming casts of the lower bowel. These cases are often diagnosed as a chronic ileocolitis and treated with astringents and rectal irrigation, which only aggravate the condition. Local treatment is best omitted. The management of the case is one of feeding, with careful attention to the general hygiene in regard to sleep, exercise, baths, and massage, as indicated in cases of malnutrition from any cause.

DISEASES OF THE LIVER

By Charles G. Stockton, M.D.

FUNCTIONAL DISEASES OF THE LIVER

The liver, like other abdominal organs, is subject to functional disturbance dependent upon a variety of influences, some immediate, others remote in origin. These influences may act through the innervation, the circulation, and the metabolic power of the organ. The liver has its nerve-supply from the hepatic plexus of the sympathetics, the pneumogastrics, and the right phrenic, and is thus exposed to sympathetic influences arising in the cerebrum, the thorax, and the abdomen. It receives its arterial blood-supply from the hepatic artery, the largest of the branches of the celiac plexus. This vessel, like other abdominal arteries, is actively affected by vasomotor impulses. It arises in a portion of the aorta prone to structural changes, —inflammatory and degenerative in nature,—and these may interfere with the hepatic blood-supply. A large amount of blood also reaches the liver from the valveless portal veins, the four large branches of which connect with viscera differing widely in function, yet so closely associated that a striking sympathy exists between them. It may be assumed that the character of the blood coming from a disturbed stomach, spleen, large or small intestine may from time to time differ widely, so that the functional strain demanded of the liver must likewise differ in degree, dependent upon the amount and character of the food, upon the condition of the gastric and intestinal digestion, upon the presence of gastric or intestinal stasis or overactivity, upon the presence of putrefactive or toxic substances in the gastro-intestinal tract, upon the toward or untoward behavior of the spleen, the blood, and the blood-making organs.

The liver is drained by the hepatic veins and the biliary ducts, in either of which may be found the causes of active disturbance of the hepatic function. If from any cause the blood-current in the hepatic vein is diminished or interrupted, the liver must at once feel the effect, which leads us to reflect on the immediate relation existing between the thoracic viscera and the liver. In the same way from the narrowing of the biliary ducts, whether from over-tonus or spasm the result of disturbed innervation, from irritation of any kind, from inflammation or obstruction by any cause, there must inevitably result a marked derangement in the function of the liver. Clinical experience teaches us that the liver is deranged through undue mental excitement, over-fatigue, great variations in temperature—all members of a numerous group of factors which, though at first thought apparently far removed from relations with the liver, are nevertheless found to affect its functions. There can be no doubt about the frequency of the occurrence of these functional disturbances nor about their importance, but there is difficulty in isolating one and excluding other possible active factors in any given hepatic derangement. One is embarrassed by the possibilities, and at times must be guided by inference rather than by demonstrable facts.

As is well known, the function of the liver becomes sympathetically disturbed in a great variety of acute and chronic diseases, and at times this hepatic disturbance has an important bearing upon the course of the disease in question. One realizes the importance of the fact, but is often perplexed in attempting to separate from the complex those symptoms which arise only in the liver disturbance, and in determining which of the symptoms depend upon functional derangement and which upon structural changes in the liver. Nevertheless, success in the treatment of disease depends upon an understanding of the various factors giving rise to a symptom-complex and upon due estimation of the disturbed physiology of the organism. From this standpoint, we are encouraged to analyze as far as possible the underlying causes of hepatic disturbance, and to base therapeutic measures as far as practicable upon a physiologic basis; at the same time it must be realized that not a few accepted and valuable measures of treatment remain partly or wholly empiric in nature.

Form and Position.—To what extent the function of the liver is disturbed by the position of the organ, or by deformity occasioned by the wearing of faulty apparel, or by the improper carriage of the body, is difficult to estimate; but it is reasonable to assume that its blood-supply and drainage may be considerably interfered with and its nerve impulses disturbed. These factors are likely to interfere with the satisfactory work of the organ. There is no doubt but that displacement of the liver often, and deformities from pressure in a few instances, occasion discomfort and even pain. The sensation is often expressed by the terms "weight" or "heaviness," but pain may result, sometimes even developing into true neuralgia. When such symptoms depend upon displacement, the treatment becomes surgical rather than medical in character.

Neuralgia of the liver, which is likely to be confounded with pain arising in the abdominal or thoracic parietes, the diaphragm, the biliary passages, or other abdominal viscera, has nevertheless a place and must receive consideration. When it depends upon faulty position, it should be corrected by measures already described. When it depends upon diminished arterial blood-supply through sclerosis of the celiac plexus or hepatic artery, measures must be adopted to increase, if possible, the caliber of these vessels and the volume of blood going to the liver. This often may be accomplished by hydrotherapy; one of the best measures being the application of the hot Preissnitz compress, or a large poultice extending from the lower thoracic region to the pubes and well around each side. The full hot bath at times has a most beneficial effect, and a warm affusion over the abdomen for fifteen minutes to half an hour is a useful measure. At the same time large drafts of simple infusion of herbs, like mint, hops, linden flowers (tilleul), or chamomile, help to lessen the tension of the abdominal vessels and favor the visceral circulation. Temporary relief may be had from drugs that act more directly on the vasomotor centers or the terminal nerves; and of these, aconite in frequent small doses, sometimes, however, in doses as large as 5 to 10 drops of the tincture, every hour or two for two or three doses, is of signal service. Of the nitrites, nitroglycerin is convenient and satisfactory if used in sufficiently small doses, often repeated. The dose should be given at least every hour and should be correspondingly small. Occasionally it is good practice to employ agents to increase the heart action while lessening the vascular tonus, and of these ether and alcohol take the first place, but their use should be temporary in character. For the more permanent relief of the symptoms depending upon sclerosis of the hepatic artery we must rely upon hydrotherapy, improvement in hygiene, diminishing the physiologic strain of the liver by a restricted diet and by the use of the iodids for a prolonged period, and, occasionally, by a short course of mercury. Needless to say, anodynes may have to be resorted to when the pain is severe, but as their effect is not curative, their use is to be avoided when possible. Indeed, when the diagnosis of arteriosclerosis is correct, it will be found that measures which dilate the abdominal vessels will give more prompt and satisfactory relief than anodynes.

Excessive and Diminished Secretion of Bile.—Polycholia and anacholia have long been regarded as entities dependent upon physiologic disturbance in the liver, and yet it is most difficult to reach even an approximate notion of the place which these conditions occupy in functional disease of the liver. The customary method of depending upon the color of the stools is known to be unsatisfactory, since pigment may be present, coming either from the bile or from other sources, which would lead one to suspect an active biliary secretion when the reverse is true; and, on the other hand, there may be an active secretion of bile with a decrease of pigment matter. This in part depends upon the fact that the liver is a hemolytic organ, and hence may discharge coloring-matter in undue proportion, while the biliary salts and other constituents of the bile are greatly decreased. This is illustrated by Stadelmann's experiments with toluylenediamin and arseniuretted hydrogen. After the injection of these hemolytic agents, setting free a large amount of hemoglobin, the coloring-matter of the bile was greatly increased, although there was a corresponding falling-off in the other biliary constituents. It is difficult to reach a clinical knowledge as to the amount of bile that is being passed and as to the proportion of the various constituents of the bile. Nevertheless there is abundant reason for believing that the activity of the liver in respect to bile secretion varies from time to time as to both its quantity and quality, and until physiologic experiments prove to the contrary, the clinical belief in the fact cannot be disregarded.

There are cases in which the economy seems flooded with bile, in which large, liquid, bile-colored stools are frequent, accompanied by excessive intestinal peristalsis, occasionally by vomiting of bile-stained matter, also with a more or less intense icterus, with biliary coloring-matter in the urine. There is also an occasional case with biliary fistula in which the amount of bile discharged is much beyond that seen under ordinary circumstances. On the other hand, it is common to find patients with pale and sometimes insufficient stools, without evidence of biliary obstruction or other disease of the biliary passages or the liver, but in whom there is evidence of hepatic incompetence in other respects. For instance, such patients are not able to eat the customary amount of food without inducing well-known symptoms of autointoxication. From the reason that this state of the liver subsides after a time, leaving the organ as competent as before the attack, the usual amount of bile appearing in the stools, it may be inferred that the disturbance was functional and unaccompanied by a hepatic lesion. It is true that such manifestations may be present in cases in which the liver shows signs of disease, such as enlargement or decrease in bulk. Under such circumstances the excessive or decreased flow of bile would be regarded merely as a symptom of congestion or other structural process, exciting or depressing the functional activity of the organ. In laying out a plan of treatment for such cases one feels the need of lessening the physiologic strain upon the organ, so that in either condition somewhat similar measures of treatment might be adopted. When the flow of bile appears to be profuse, the patient should be given rest, if possible in the open air, or, properly protected, in a room with opened windows. The oxygen supply should be large, but the surface of the body should be kept warm. The diet should be greatly restricted, in both quality and quantity, and the patient should follow the usual rules of the hepatic dietary, hereafter to be considered. Water may be drunk in usual but not large amounts. The skin should be stimulated by warm baths and such drugs administered as from experience are found to have a sedative effect upon the portal circulation. For instance, there may be prescribed the drinking of iron and alum natural spring-waters, or the administration of astringent infusions or, in exceptional cases, the administration of atropin or opium in small quantities. In excessive functional activity of the liver, relief is said to follow the introduction per rectum of the prepared pancreas of animals, and arsenic is also stated to have an inhibiting effect. On the other hand, in deficiency of biliary secretion water should be given in large amounts, preference being given to the saline and sulphur waters; inspissated ox-gall in doses of from 1 to 3 grains, given by the mouth in capsules, or a dram of the same dissolved in a pint of water, may be used as a clyster. Measures calculated to induce a larger flow of blood to the liver should be practised. These include massage, in the form of vibration or light percussion, over the abdomen, and especially over the region of the liver; the application of faradization; the alternating hot and cold douche; and the hot compress or poultice.

There is a large array of drugs which are popularly believed to have a specific action in promoting the flow of bile, but physiologic experiment does not warrant confidence in their efficiency. The misconception arises from the fact that most of these drugs have a stimulating effect upon the intestinal glands, and the color and frequency of the stools which result are erroneously attributed to an increased secretion of bile. Others stimulate the unstriped muscle-fiber of the biliary ducts without influencing secretion. Our attention was first drawn to this matter through the well-known experiments of Rutherford, who showed that magnesium sulphate, gamboge, castor oil, and calomel stimulated the intestinal glands, but rather diminished than increased the secretion of bile. This observer was convinced that the flow of bile was moderately excited by sodium phosphate, mercuric chlorid, ipecacuanha, colchicum, colocynth, aloes, and jalap. Rhubarb and dilute nitro-hydrochloric acid were feeble stimulants. These conclusions are not altogether sustained by other observers. Mayo Robson, in a case of biliary fistula, found no increase in the outflow of bile after the administration of calomel, euonymin, rhubarb, podophyllin, turpentine, or benzoate of soda; but found that iridin was a temporary cholagog and that aërated soda-water produced a distinct increase in the flow of bile which was continued for a considerable period. The experiments of Stadelmann and his pupils add to our doubts as to the efficiency of so-called cholagog drugs, and some observers go so far as to deny their existence.

Prevost and Binet found in experimenting upon dogs that the secretion of bile was increased by the administration of bile, salts of the bile acids, urea, oil of turpentine, sodium salicylate, salol, sodium benzoate, euonymin, muscarin, and sodium oleinate, and that it was decreased by the administration of potassium iodid, calomel, iron, atropin, and toxic doses of strychnin. Slight effects were obtained from other substances. It will be noticed that bile and biliary salts appear to be our most powerful cholagogs. It is an interesting fact that the salts of the bile acids are largely reabsorbed in the intestine, and to some extent are again excreted with the bile.

The frequency of jaundice and the fact that its presence may develop a sequence of serious events makes important the subject of the secretion of bile; but, at the same time, it is plain that the secretion of bile is not the most important function of the liver. The rôle which this organ plays in the modification of practically all nutritive substances introduced into the organism, and its action in preparing for elimination the waste matters of the body, must be accounted as of greater moment.

DISTURBANCES IN HEPATIC METABOLISM

Besides this, it seems to be established that the liver has an important part in the destruction and discharge of microbic organisms, which pass to it, for the great part, through the portal blood. Intricate and, so far, inexplicable as are many of the processes connected with these functions of the liver, we are aware that they are vital to the economy, and, with apparently slight disturbance in the hepatic chemistry, make themselves immediately felt; more serious disturbance may promptly lead to dangerous results. The perversion of the delicate chemistry of proteid substances seems most to tax the activity of the liver; but, as is well known, in the disposal of the carbohydrates and in the formation and release of glycogen, there remains for the liver a function of great importance. The assimilation of fats, which largely proceeds through the medium of this organ, is apparently more simple, and is a process which, to some extent, goes on exclusive of the liver. Nevertheless, the liver assumes the responsibility of the disposal of no small part of the ingested fats, and this matter must be taken into consideration in the management of functional disorders of the organ. If we could be certain that the various nutritive substances passed into the portal vein only after having been properly acted upon by the several organs of primary digestion, the problem of functional disorders of the liver would be greatly simplified. As a matter of fact, the liver is rarely or never disordered without the association of functional or other disturbance of the organs of primary digestion. We are beginning to understand how close is the relation which exists between the gastric, duodenal, and pancreatic secretions, and how necessary it is to have properly related the activity of these organs in order to secure satisfactory intestinal digestion. When intestinal stasis is present, with or without putrefactive decomposition of the intestinal contents, there is thrown upon the liver a physiologic strain which every-day practice shows to be causative of hepatic derangement. One of the most difficult problems connected with the question is that of excluding the untoward action of the other abdominal viscera before impugning that of the liver. It is for this reason that most purgatives are supposed to have a direct influence upon the liver. The various foods which are popularly believed to be good or bad for the liver, as the case may be, will, when carefully studied, turn out to be but instances of imperfect primary digestion, accompanied by structural or functional disturbances of the stomach or the intestine. Usually there is a certain amount of intestinal stasis, irritation or inflammation of the intestinal mucosa, and a resulting systemic toxemia, which, in the past, we have been too ready to believe as originating in the liver. The truth is it suffers, but in a merely secondary manner.

Like other organs, the liver seems to have limitations within which it successfully does its work, but beyond which it reacts unfavorably to overtaxation. This state may be induced by excessive alimentation as well as by absorption of toxic and unwholesome substances. It is apparent that the individual factor is important in this matter of overtaxation, for it is seen that some can, with apparent impunity, tax the digestive apparatus with a quantity and quality of food that would induce marked hepatic disturbance in the ordinary individual. The urine may reveal hepatic insufficiency through the appearance of alimentary glycosuria, decrease in urea, and increase of the ammonium compounds, increase of the toxicity of the urine, indicanuria, urobilinuria, and also alimentary levulosuria. Edsall considers the latter an indicator of little importance. On the other hand, Chajes in 88 cases of liver disease found that 86 per cent. had alimentary levulosuria, while in supposedly healthy livers only 15 per cent. showed this. Strauss's experiments showed practically the same.

The urea is formed by the liver from albuminous waste brought to it, and the extent of its production depends upon the state of the general nutrition.

Urea may, however, be decomposed, through the supposed diastatic action of bacteria, as in cystitis or pyelitis. I have seen in a severe case of diabetes, with great wasting of tissue, the urea output drop to a very low point when the urine was practically sterile, possibly from the action of some enzyme formed in the diseased organism. The urea-forming power of the liver continues even in severe organic disease of the liver and does not cease until the liver is practically broken down. Nevertheless, its function is frequently disturbed by comparatively trivial causes. In the acid intoxication of the organism the urea is decreased. Such acid intoxications are in great part dependent upon disturbance outside the liver; the liver is only indirectly responsible.

The matter may be stated briefly as follows: When the liver structure is reduced, or when the hepatic function declines, there is found to be a corresponding diminution in the urea that is secreted. There also occurs a corresponding increase in the ammonia output. While in health the ammonia nitrogen does not exceed from 2 to 5 per cent., it rises in case of hepatic disease to 7 per cent., 15 per cent., or even as high as 70 per cent., of the total nitrogen of the urine; and, in addition, there may occur an accumulation of ammonia in the blood. In addition to this, in the urine of those suffering from hepatic insufficiency there is found an excess of the amid acids, uric acid, xanthin bases. While the origin of these, like that of creatin, sarcolactic acid, oxalic acid, etc., is still under discussion, the fact remains that they are present in relative frequency and abundance in the urine when the liver is incompetent.

We are less positive as to the question of glycosuria as a manifestation of disease of the liver. However, not to rehearse the pros and cons of the discussion, it may be stated that in case of advanced cirrhosis of the liver one may expect to find sugar appearing in the urine, especially after meals abundant in carbohydrates. Gilbert insists that, taken in connection with failure in nitrogen metabolism, this fact is of diagnostic importance.

A lowered elimination of urea and a corresponding increase in that of urate of ammonia speaks for a decreased functional activity of the liver. It is increased by the ingestion of ammonium carbonates and decreased by the alkaline treatment.

The question of hyperalimentation is of great importance in its relation to the behavior of the liver, and plethora seems also to have some bearing in the same way. A patient of middle age, with sound organs and without cyanosis, showed functional hepatic disturbance; both liver and spleen were slightly increased in bulk, and a count of the red blood-cells showed 6,500,000 erythrocytes and a hemoglobin index above 100. The circulation was active, the blood-vessels were well filled, and the blood-pressure by the Riva-Rocci instrument was about 190. So far as can be determined, the sole trouble with this man was the excess of blood.

The liver is still more sensitive to the influences of anemia; almost the earliest structural changes resulting from any severe anemia are found in this organ. Starvation also affects the liver most unfavorably, lowering its functional activity and inducing degeneration. Cruet examined the livers of 765 dyspeptics who were on a restricted diet, and found that in 95 per cent. there was decrease in size and downward displacement of the liver, which the author attributes to partial starvation. Similar observations and conclusions have been made by Mathieu and Roux. In the high temperature of fever, especially in the infections, the liver suffers functional depression as well as structural change. Somewhat similar results follow the development of glycosuria, even when this arises from lesions outside the liver. Among the most frequent associations is that of uric acid excess and hepatic derangement, and much controversy has arisen as to just how far the liver is an offender in these cases. In the breaking down of leukocytes and the freeing of nucleinic acid the liver is required to deal with the waste matters, and in this way is directly concerned in the formation of uric acid. It has also to deal with the xanthin series of substances introduced through certain foods. There is a belief that the liver also forms uric acid rather than urea in dealing with the end-products of protein metabolism. The reasons for accepting or rejecting this view, with our present knowledge, need not here be discussed. The fact is evident that uricacidemia is closely related with the functional activity of the liver, and clinical experience teaches that in some individuals the liver is keenly sensitive to indiscretion in diet, especially in those leading inactive lives and suffering from suboxygenation; and this derangement is shown through the excess of uric acid thrown upon the organs of elimination. However this may be explained, we find, as pointed out by Murchison, that a chain of irritating symptoms, apparently depending upon the presence of uric acid, makes itself evident. In so-called lithemia the liver is usually slightly enlarged, apparently congested; metabolism suffers, and nervous symptoms, disturbed secretions, and irritation of the synovia appear; the urine becomes highly acid and, as a rule, precipitates crystals of uric acid and calcium oxalate crystals; occasionally an excess of phosphoric acid or the acid phosphate of soda occurs in the urine, which may throw down large deposits of the earthy or triple phosphates.

THE RELATION BETWEEN THE LIVER AND KIDNEY

This intimate relation existing between the liver and kidneys is seen in all cases of renal insufficiency, and especially in the uremia of nephritis. As a rule, when the liver is seriously disturbed, the renal symptoms are conspicuous. Even simple jaundice is accompanied by albuminuria, the presence of tube casts, and deficiency in renal elimination. To discuss fully the reasons for hepatic derangement secondary to kidney disease is impossible here, but the importance of the matter is not to be overlooked; indeed, it is often possible to improve the renal function through measures directed solely to the liver. In all these conditions there is apparently one common need, and that is a large oxygen supply. It is impossible in all cases to show the chemical reason for this, yet it may be put down as a fact that in all metabolic disturbances, which so largely concern both liver and kidneys, increased oxygenation affords more or less relief. It is held with much reason by many clinicians that a large part of the hepatic disturbances are secondary to gastro-intestinal disease. It is a subject of great importance and one too much neglected. As has been said, the reputation of most cholagogs depends on their action in hastening the intestinal stream rather than upon any immediate action upon the liver. In dilatation of the colon, in enterocolitis, in constipation resulting from enteroptosis, as well as in diarrheas from almost any cause, we find that the liver suffers secondarily from functional disturbance, and that not infrequently it undergoes congestion or inflammation. Hyperchlorhydria is a good instance of a stomach trouble which deranges the liver; such patients suffer periodically from toxemia, usually with slight increase in the size of the organ, and, after proper treatment, these symptoms pass away and the liver resumes its natural size and function. These statements apply also to food stagnation from pyloric obstruction, and to the milder gastric disturbances, like atony or catarrhal gastritis.

NERVOUS DISTURBANCES AND THE LIVER

Finally, as a cause of functional derangement of the liver we may look to the central nervous system. Sometimes, after intense emotional excitement, prolonged worry, mental fatigue, etc., we find undoubted functional disturbance of the digestive apparatus, apparently induced through the sympathetic nervous system. There is reason to believe that the liver receives the brunt of these nervous shocks in a certain proportion of cases. Thus we may sometimes explain an apparent suppression of bile or marked disturbances in metabolism. In a few instances jaundice supervenes, together with malaise, complete anorexia, and apparent partial inhibition of the other liver functions. At times, where there is considerable cerebral irritation as the result of sinusitis, middle-ear or antrum disease, or aggravated eye-strain, it is probable that the liver suffers with other organs.

TREATMENT OF FUNCTIONAL DISEASES OF THE LIVER

The principles of therapeutics in functional diseases of the liver are so closely related that for the sake of brevity they may be discussed in common. In the beginning it is well to realize that in any given case there is an individual standard of the hepatic activity; that is to say, most probably, the hepatic functional power in one person differs from that in another. With this in mind, the plan of treatment should be such that the work demanded of the liver is sufficiently decreased in a given case to allow the organ its needed time for recuperation. Too active exercise should be forbidden, while advising a sojourn in the open air and sunlight. To equalize the circulation, the patient should be well protected by loose garments, which leave unrestricted the respiratory apparatus and favor the normal movements of the abdominal viscera. Prescribed respiratory exercises and passive movements of the limbs, with assistive trunk rotations and limb circumduction to favor the circulation, are often of great service. The secretion of the skin should be excited by brisk superficial friction, the hot brine or acid sponge bath, or a brief immersion in a very hot brine bath, occasionally by a hot vapor bath or the superheated air in a cabinet. In most cases the gastro-intestinal tract should be cleansed by a bulky, unirritating purgative, such as a full dose of oleum ricini or a bottle of effervescing citrate of magnesium, a full dose of magnesium or sodium sulphate, or a draft of one of the purgative saline waters. This should be followed by a thorough gastric lavage and colon washing. In practising the latter it will be well to carry a large sized rectal tube into the sigmoid, requiring the patient to lie first upon the left side, then on the back, and finally on the right side, so maneuvering that a large quantity, from 2 to 3 liters, of hot boric acid solution may be introduced at one time. When increased alkalinity of the fluids of the body is desirable, it is well to resort to a 1 per cent. solution of sodium phosphate or bicarbonate for this purpose. Presuming that the gastro-intestinal tract has been cleansed as thoroughly as practicable, abstinence from all food for from twelve to twenty-four hours should be insisted upon, and the return to feeding should be gradual and according to the dietary hereafter to be described. To favor the action of the kidneys, to lessen general toxemia, as well as for the reputed effect upon the functions of the liver, the patient should be urged to drink freely of water. In many instances it is enough to know that the water is pure and well aërated. In some instances it is well to select one containing a moderate amount of carbonic acid gas, and in others, frequent small drafts of highly charged water should be taken. Where, as often happens, the urine is highly acid, a distinctly alkaline water should be selected. In such a case it is well to choose a spring containing the bicarbonates of sodium, magnesium, and potassium in preference to one containing the carbonates. The question of mineral waters is so complicated, so many springs of a mixed and somewhat mysterious constituency are advocated, and the effect of some of them is so uncertain that it is impracticable to discuss them here at length. There can be no doubt, however, that the régime prescribed at many European Spas brings about salutary results, and such a course is to be recommended in chronic cases which depend upon persisting causes. We have undoubtedly in this country many springs equally efficient with those abroad, but our European confrères have the advantage of established courses of treatment, and they manage the patients more easily. The surroundings, including the hotels, amusements, scenery, outdoor occupations, and the example of many following the established course contribute largely to the contentment of the patient, and hence his persistence in following the treatment. The patient rises at six or seven o'clock in the morning and, without refreshments, walks a short distance to a Spa or "source," and, slowly and at prescribed intervals, drinks a stated amount of mildly purgative water. If his strength permits, he promenades, listens to an excellent orchestra, and finds interest in the people about him. This will occupy an hour or an hour and a half, during or after which he has two or three watery alvine evacuations and free diuresis, and returns to his hotel about nine o'clock tired, sometimes half faint, often depressed, and prepares for his breakfast, which is served about ten o'clock. This is appetizing, perfectly prepared, and not too hearty, the hotels lending themselves willingly to the diets prescribed by the physicians. Following breakfast the patient feels invigorated and for a few hours is left to rest; or part of the time may be spent in driving and, when strong, in walking, playing golf, or some other outdoor recreation. At four he again repairs to the springs, where he repeats somewhat less strenuously his experience of the morning; that is, he again drinks of purgative water, walks with the crowd, and listens to the music. Again he has a purgative action, and retires at his hotel at five o'clock to dress for a six o'clock dinner, tired but usually ready for the meal. Some days may elapse ere the appetite returns, and before the patient has acquired sufficient physical vigor to make this life anything less than a burden; but where the trouble is merely functional, a few days suffice to reestablish a freshness of taste and a feeling of energy from which he has long been estranged; and, as a rule, he is ready to go to bed according to the rule of the place, at ten o'clock, prepared to enjoy a calm sleep. Should his nervous system prove rebellious and insomnia remain a disturbing factor, coffee and tobacco should be omitted and a soothing draft of about 300 to 400 c.c. of linden flowers tea (*thé de tilleul*) or some other soothing infusion should be drunk. After a week of this treatment the patient usually finds himself well and is inclined to rebel against the restrictions, but pride will help him to keep it up for the prescribed time. Following this he is sent, as an after-treatment, for a sojourn in the mountains, which, taken in connection with the preceding regular régime, usually makes a new man of an hepatic sufferer. This method of treatment is gone into somewhat minutely, because it is employed successfully not only in functional diseases of the liver, but also in at least relieving the majority of hepatic diseases in which the patient is not too much enfeebled. In cases where the hepatic parenchyma is much degenerated, and in which hepatic insufficiency therefore occurs, or in which the circulatory, respiratory, or urinary apparatus are seriously crippled, the course of the treatment must be correspondingly modified, and for this purpose an experienced physician must be in charge of the case. It is regrettable that plans of treatment similar to those here described are not more perfectly and conveniently carried out in our own country, although a noticeable improvement in our methods is observable.

THE "TORPID LIVER"

The older clinicians have at times grouped many of the symptoms above described as being manifestations of a definite functional disturbance which they called "torpid liver." After many years this term is reappearing. It is used to describe a marked tendency on the part of certain individuals to functional disturbance of the liver in which, without very logical reasons so far as can be seen, it is assumed that the liver is inactive. The subject has been ably discussed by Loeper* under the term "Le Foie Torpide." Patients who suffer from this condition are sometimes found to have enlargement of the liver, and in other instances the organ is small. There is at times the history of gout, migraine, eczema, and herpes. Another group include those who suffer from various forms of primary digestive troubles. Such patients in fact, as one would suspect as being victims of chronic appendicitis or cholecystitis. However, any one who sees a large number of abdominal cases will occasionally encounter one in which he feels able to exclude all local causes, reflex or otherwise, but yet in which the evidence of hepatic derangement is striking. For a long time I have studied the case of a gentleman, past middle age, athletic and previously always well, who for over a year has been subject to attacks of unaccountable vertigo, accompanied by transient enlargement of the liver, without pain or tenderness. Preceding the attacks the appetite is increased and he feels particularly well. The urine shows an increase in pigment and in acidity, but there is apparently no decrease in the secretion of bile. In this case there has been no positive evidence of anything more than functional disturbance of the liver, and I believe that it is proper to classify it as an instance of "Foie Torpide." The patient is always promptly relieved by a restricted diet and purgation with alkaline and saline waters.

DIET IN DISEASES OF THE LIVER

The dietary regimen in diseases of the liver admits of rather general presentation, but as the matter occupies a large place in the treatment of these affections, it will be gone into with some detail. To begin with, there may be laid down two rules, formerly expressed by Linossier.† The regimen of a patient having hepatic disease should always be managed with reference to the gastro-intestinal condition, and if dyspepsia is present, such a diet should be selected as will improve it. The regimen in all liver cases should be moderate in quantity. These two rules are of great significance. If the diet is selected with theoretic reference only to supposed condition of the liver, there is likely to ensue a derangement of either the stomach or the intestine that will give rise in turn to liver troubles. Attention should be paid, therefore, to the state of the gastric and intestinal digestion in both the quantity and quality of food and also the frequency of meals. In case there exists known gastro-intestinal disease, the diet should be arranged with reference to these affections rather than the liver.

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*Loeper: Bull. Méd., June 26, 1909.

†Linossier: Société de Therapeutique, Seance de Feb. 24, 1904.

Laying aside the question of gastro-intestinal digestion, it should be recalled that the function of the liver is especially concerned in the disposal of albumins. Meats rich in fats, young meats like veal, and meats so prepared by broiling or frying that the empyreumatic substances are produced in abundance, such as are found in many gravies, are especially harmful. On the other hand, meats that are for a long time boiled or stewed, and from which the fat has been largely removed, are tolerated with comparative ease. It is desirable, therefore, to use boiled or stewed meats rather than those that are grilled, fried, or roasted. When the latter method of cooking is practised, a slow fire should be used to avoid a too rapid chemical change. Of the salt meats, ham is the least harmful, but it should be boiled according to proper rules.

The fats are found to be especially harmful in hepatic cases, and to most patients so afflicted all fats are distasteful. There is, however, a difference; some are more objectionable than others. It is believed that those most easily emulsified and having the lowest point of fusion are least harmful. For this reason, cream and butter are preferable to the fats of meats or vegetable oils. The fat from pork is less harmful than that from beef or mutton, and the cooking of all fats should be avoided. In the decomposition of fats by superheating there result chemical products which are especially disturbing to the stomach and liver. It is for this reason that fried foods are usually forbidden to dyspeptics, and when, for the sake of savors, fats are used in the dressing of food, butter or cream should be selected when possible, and these should be allowed to melt upon the vegetables or other foods just before serving. With reference to fish, it is of the utmost importance that they should be very fresh and as much as possible free of fats. A perfectly fresh fish will be digested without trouble, when one which has been stored will give rise to serious disturbance. Mackerel, sturgeon, shad, and other fish rich in fat should not be allowed the dyspeptic or one having hepatic insufficiency. On the other hand, fresh-water perch, bass, pike, or similar fish from the sea, if prepared when fresh, are often very acceptable to these patients.

The carbohydrates, in whose assimilation the liver is so much concerned, must never be given in large amounts, nor should they be entirely discarded. The gastro-intestinal digestion should be carefully considered in determining the amount allowable. As a rule, gruels and porridges that are thoroughly cooked, stale bread, cold or dipped and baked the second time and served hot, should be chosen. Zwieback or crackers which do not contain too much fat may be used, preferably toasted. The simplicity of the dish is a matter of importance.

Combinations of fats and carbohydrates, or albumin, carbohydrates, and fats, if cooked together, are more troublesome to the digestive apparatus than any of them prepared separately.

The use of eggs is not forbidden when they are fresh, properly prepared, and when they have not been found mischievous by experience. Not a few people have an idiosyncrasy against eggs which is not easily explained. It has been suggested that this is an expression of anaphylaxis. It has been held that the yolk of the egg is the offending factor, but this view seems to be unwarranted. The amount of cholesterin which the yolk contains is not a reason for omitting it, for, as Naunyn has shown, the taking of cholesterin in food is not followed by an excessive elimination of it through the bile-channels.

Of all foods, none satisfies the demands of the economy so well, none is so free from objections, as milk; and yet in practice it has been forbidden in a proportion of cases because of inability to digest it. Distaste for milk is more common than might be supposed. Often this is a mere notion on the part of the patient, and it will be found that milk can be taken if it is sufficiently fresh and well cared for. Sometimes it will agree better if it is combined with a little farina, with seltzer water, by peptonizing it, adding to it an alkali or using it in the form of junket. Clabber, buttermilk, kumiss, and matzoon are sometimes well tolerated when fresh milk disagrees. Indeed, the presence in the intestine of the lactic-acid-forming bacilli is believed by some to exercise a most wholesome influence upon the general economy, and the long-lived Bulgarian and Irish peasants, inveterate drinkers of sour or fermented milk, are cited as justification of this belief. Such people subjected to an American dietary are often acute sufferers. Except in acute cases it is rarely advisable to restrict a patient for a long time to a milk diet.

Europeans, and especially the French, highly recommend certain green vegetables in the treatment of hepatic diseases. When vegetables disagree, it is often because they are imperfectly prepared. It is not common to find vegetables served in the most appetizing and digestible form. Both these matters are important in good digestion. In my experience the vegetables prepared in the ordinary kitchen are badly digested, and a systematic study of the stools will reveal that not a small proportion is passed undigested, but concealed in the fecal matter. Nevertheless a certain amount of vegetables should be used. Here, again, freshness is of importance, and vegetables just from the garden will agree when those ordinarily sold in the market are harmful. Tender green peas, string-beans, artichokes, ripe tomatoes, and cooked salads, especially boiled lettuce, with mealy boiled or baked potatoes, are to be preferred. Spinach is objectionable to many because of the excess of the oxalates which it contains. Well ripened fruits, when fresh, are not only admissible, but desirable when they do not lead to gastric disturbance. With some, the presence of the seeds in berries leads to their exclusion. Strawberries especially are harmful to certain people.

Tea, coffee, cocoa, and alcohol are best omitted. Warm aromatic teas or hot lemonade should take their place. Water should be taken in abundance, but with due regard to the gastric digestion, yet, as has been said, the charged alkaline waters are often particularly useful.

It has been urged by some that the meals should be taken frequently, since eating acts distinctly as a hepatic stimulant. This reasoning applies in the opposite direction in a goodly proportion of cases. Where it is desirable to stimulate hepatic secretion, frequent meals are to be admitted, but where it is desirable to soothe an irritable or congested liver, where the element of rest is important, the meals should be far apart and light in character. Finally, it should be remembered that practically all foods must first pass through the liver before assimilation. Therefore, when the liver is incompetent, the question is not alone what kind, but, that which is of as much importance, what quantity of food is to be allowed. This question recalls the second rule of Linossier: whatever the diet, it should be carefully seen to that the quantity is never more than moderate.

Although a period of fasting and subsequently a diet greatly diminished in quantity often serve best for a short period in great incompetency of the liver, it is necessary to remember that the general nutrition of the body will suffer if a proper standard of nourishment is not soon resorted to. For this reason the question of diet in liver diseases is a most embarrassing one. Rübner states that for an adult weighing 65 kilograms there should be taken during rest in bed 1800 calories daily; during repose, 2100; in light work, 2300; in moderate work, 2600; and at hard work, 3100. Atwater regards 5700 calories as not too much for one engaged in severe muscular work. It will be seen that the least of these, namely, 1800 calories, that which Rübner would allow during rest in bed, is far in excess of the diet that can be safely adopted by many patients suffering from severe hepatic insufficiency. Each case must be a standard unto itself. In most instances it is best to approach as nearly as possible the standard of nutriment for a given state of activity. If we allow food in excess of the assimilative power of the organism, the patient will suffer from toxemia. If we do not provide for the needs of the organism, the liver will suffer and ultimately undergo degeneration. While the warning not to feed too much is a rule of the first importance, there should follow after this the warning that under-feeding should not be too long prescribed because of the loss of functional power of the liver which results when its full working power is not called upon.

Hepatic Insufficiency Relating to Nitrogenous Substances.—Sometimes patients seem to be most easily disturbed by slight excess of nitrogenous foods. In such instances the patient should abstain from animal proteins and attempt to supply any deficiency by vegetable food rich in gluten. Most patients are able to take milk or freshly made cottage cheese. In such patients the greatest attention should be paid to the gastric digestion. Unless there is hyperchlorhydria, it is well to give hydrochloric acid after meals, not alone for assistance to the gastric digestion, but because it is believed that acids favor the secretions of the duodenum and its accessory glands; and tartaric acid inclosed in paraffin capsules, thus passing the stomach unchanged, to be liberated in the duodenum, is held to be of distinct benefit by inducing a greater flow of secretion.

Hepatic Insufficiency Relating to Carbohydrate Substances.—There is a class of patients who suffer from taking full amounts of carbohydrates. They are usually benefited by omitting the larger part of such foods from the dietary and by increasing the intake of oxygen through insisting upon a more continuous outdoor life.

Hepatic Insufficiency Relating to Fat Substances.—When fatty foods give rise to symptoms of hepatic disturbance, it will usually be found that the primary digestion is faulty, and there are likely to occur disagreeable eructations containing the fatty acids; or an excess of fats may be found in the stools. Under these circumstances fats should be eliminated from the diet. When digestion improves, a little cream or butter should be first tried, then a little boiled fat ham, and finally the usual habit may be resumed. These rules will probably prove sufficient if the general hygiene of the patient is attended to.

Hepatic disturbances connected with over-alimentation are easily relieved by cutting down the diet. Chittenden has taught us that by sufficient mastication and an abundance of water a man may carry on the ordinary activities without losing weight, even when the amount of food is greatly reduced.

Hepatic disturbances connected with anemia are more troublesome. It depends much upon the form of anemia and upon the accompanying degeneration of the liver. As to food, the largest dietary practicable should be allowed, but it would be a transgression if the stomach or liver was overtaxed. The meals should be frequent, most carefully prepared, carbonated or oxygenated waters taken frequently, and a life in the open air insisted upon. Exercises should be moderately and regularly practised.

Disturbances connected with fever result from both the attending hepatic insufficiency and the excess of waste or of toxic matter with which the liver is burdened. The diet should be digestible, nutritious, not likely to undergo putrefactive changes in the digestive tract. A diminution of toxemia is favored by colonic lavage and mild purgatives. Without our being able to explain why, the mercurials are often of great service under these circumstances, apparently something additional to the purgative action. Repeated small doses of calomel, or an occasional dose of from 0.06 to 0.3 centigram (gr. j to v) of calomel, gray powder, or blue mass, followed by a saline, seem, for some reason, to assist the liver in its work. At other times ricin, podophyllin, rhubarb, and sodium phosphate have a most beneficial effect upon the function of the liver.

Disturbances connected with excess of uric acid are not to be explained by the action of the liver alone, but also largely by the state of the gastro-intestinal tract. There is no one diet which is a panacea, and it must vary in individuals. As a rule, the acids from certain vegetables, especially those containing large amounts of oxalates, should be eliminated. The same rule applies in oxaluria; in the latter, especially, sugar and the fruits should be avoided. It is not now possible to explain the chemistry, but in both of these conditions benefit usually follows the systematic use of alkalies. Sodium phosphate and sodium bicarbonate, potassium bicarbonate, citrate, or acetate, in doses of from 0.30 to 1.50 centigrams (gr. v to xv), well diluted, given from two to five times a day, will be sufficient. It will often be found that, owing to idiosyncrasy, some special articles of diet are particularly unfavorable in these cases.

Disturbances connected with glycosuria are sometimes dependent upon hyperalimentation; almost always upon overtaxation of some kind. The symptoms may be relieved by lessening the amount of food, or by drugs which, from experience, are found to succeed in assisting hepatic elimination. Among these, the most important are sodium salicylate, aspirin, mercury, and the purgatives. The frequent drinking of carbonated water is essential.

Disturbances connected with uremia are usually those of hepatic overtaxation, but without hyperalimentation. Relief follows a mercurial repeated two or three times a week, together with saline purgatives and the taking of water in abundance. In advanced cases the liver disturbance is often secondary to a diseased colon, but in any event colonic lavage is frequently of great use. This method is at times best carried out by resorting to the injection, four or five times each day, of relatively small amounts (from 250 to 500 c.c.—Oss to Oj) of very warm water, as practised at Plombières, in the French Vosges.

Disturbances connected with phosphaturia are very obscure. Phosphaturia occasionally alternates with oxaluria without known reason. Relief follows the general hygienic treatment and a course at one of the mineral springs such as has been described.

In **hyperchlorhydria and other stomach affections** are encountered transient or continued hepatic derangements. In hyperchlorhydria there is overstimulation of the upper intestine and liver, shortly to be succeeded by constipation and symptoms of decreased hepatic activity: In neglected cases the liver becomes slightly enlarged, apparently from congestion. These symptoms are dissipated by a mercurial, followed by alkalies and salines, and may be prevented by correcting the gastric disturbance. On the other hand, in hypochlorhydria, owing to the decrease of stimulation to the duodenum, perhaps from insufficient secretion, the pancreas and liver are lowered in functional activity. The routine examination of the stools will show that the intestinal digestion is poor, and the secretion of bile is usually defective. Almost every distinct stomach disease has its correlative in disorder of the liver, and it is impossible to consider the proper treatment of the one without including the other.

In diseases of the intestine, especially in stasis, such as occurs in dilatation of the colon, in intestinal atony, or adhesions from chronic appendicitis, there is evidence of hepatic irritation, inadequacy, and often congestion. It is impracticable to deal with such cases save by proper treatment of the intestine.

The nervous causes of hepatic derangement are difficult to measure. That they exist there can be no doubt, but they are present in association with many other derangements. Thus, the circulatory, genito-urinary, and cutaneous apparatus offer familiar illustrations. Quite as important and more immediately related are the disturbances of the stomach and intestine. It is not probable that a healthful action of the liver will take place under severe nervous and psychic strain, and treatment should be directed to securing mental calm, relief of brain irritation, sufficient rest, recreation, and orderly occupation of the mind and nervous system as the first step in treatment. In this connection I must record my firm conviction of the importance of eye-strain as an etiologic factor, and the good results following the proper correction by carefully fitted glasses.

CONGESTION OF THE LIVER

Most functional disorders of the liver are supposed to have a close relation to hepatic congestion. It is certainly a fact that when the liver is congested we meet with the familiar group of symptoms which are attributed to functional liver disturbances, and probably many causes which give rise to functional strain may result in the development of congestion of the liver. It is a well-known fact that in case of overeating the liver increases considerably in size, and it is well known that congestion follows the action of certain poisons and infections, and, if these influences continue, hepatitis results. The most familiar illustration of hyperemia of the liver is found in obstruction to the hepatic vein from any cause, most commonly observed in cardiac, pulmonary, or other thoracic disease obstructing the pulmonary circulation.

The treatment of congestion of the liver must depend upon removal of the cause. Relief should be sought in removing the various sources of functional derangement, the correction of the diet, the withdrawal of irritating toxic substances, and the reëstablishment, when possible, of the circulation so that venous stasis of the hepatic vein may be obviated. The most restricted diet, having in mind the general condition of the patient, should be practised. Toxemia should be combated by lavage, colon flushing, diuresis and diaphoresis, by the empiric use of mercury, saline or other purgatives, and possibly by the employment of gastro-intestinal antiseptics. It must be confessed that these drugs, from which so much has been expected, usually result in disappointment. Thiocol, ichthyol, ox-gall, the sulphocarbolates, are among the most useful drugs, but how much their effect is antiseptic and antifermentive is a question.

For the treatment of congestion dependent upon infections, the method is the same as in the preceding conditions, with, of course, the general treatment for the infection, as, for instance, quinin in malaria and antitoxin in diphtheria. When an inflammatory reaction results, or when congestion from any cause persists, something can be accomplished by external treatment. The application of hot compresses, the use of the hot affusion or douche, having in mind the dilatation of the capillaries and therefore bettering of hepatic circulation, are measures most comfortable to the patient. In exceptional cases an opposite course proves most satisfactory; that is to say, the application of cold compresses or the ice-bag, with the object of decreasing the blood-supply to the part. The latter course is likely to be accompanied by decrease of functional activity of the liver, but nevertheless, when dealing with a distinct inflammatory process, some good may be accomplished by it. When there is an unobstructed biliary apparatus, the outflow of bile should be favored by salicylic acid, sodium oleate, and effervescing waters, and the intestines should be opened by saline purgatives. Even when the hepatic congestion is not the immediate result of cardiac or pulmonary disease, but where, as the result of general relaxation, there is found to be a low blood-pressure, relief of hepatic symptoms may follow the use of small doses of digitalis. Large doses of nux vomica may accomplish the same end and have an additional value through stimulation of cerebrospinal innervation. A brief cold spinal douche is a most efficient nerve stimulant, and the effect in some instances is heightened by the alternating hot and cold spinal affusions. Medical gymnastics offer an effectual means of improving the general circulation, and thus indirectly assist that of the abdominal viscera. Of first importance is systematic deep breathing, which, in feeble patients, should always be assisted by the operator. Trunk rotation and massage may be added. In long-standing cases, where the vessels of the liver are distended, and where the unstriped muscle-fiber is inactive, relief sometimes follows hand vibration with gentle compression applied over the region of the liver, but attention must be given lest this method should produce irritation and an increase of the congestion. It should only be practised by a skilled operator under the direction of a thoughtful guide. Theoretically, the use of the rapidly interrupted electric current should be of benefit in these same cases, but reliable data on the results have not been found. Finally must be mentioned the empiric use of iodin. This remedy, usually employed in the form of the potassium salt, when given in large doses and for a considerable period has the effect of decreasing the size of the enlarged liver. Whether or not it decreases the functional power of the liver remains to be proved, and just how it acts in reducing the volume is not perfectly understood. We can understand its action in hepatic syphilis, but its benefit, although more conspicuous, is by no means limited to such cases.

ANEMIA OF THE LIVER

The liver suffers in general anemia, whether from hemorrhage, chlorosis, pernicious anemia, or anemias secondary in nature, in part because of deficiency in quality and quantity of blood, and in part because of the hemolytic function of the liver and of the overtaxing of that function which may result. In starvation the liver degenerates not alone from the decline in the blood, but also from the development of abnormal acids and other toxic agents. In arteriosclerosis with narrowing of the hepatic artery the function of the liver is frequently depressed and the gland undergoes degeneration. It is evident that the hepatic blood-supply can be much decreased in case of contracting perihepatitis. In the treatment of conditions resulting from general anemia little improvement can be expected save by relief of the systemic condition. Under such circumstances abundant feeding is demanded, but overfeeding is likely to induce gastric and intestinal indigestion and catabolic disorders of the liver. Vomiting, diarrhea, and toxemia not infrequently result from the treatment of general anemia, for which symptoms the liver must be held indirectly responsible in not a few instances. The treatment must depend upon care in the selection of the diet, in permitting the patient to eat frequently and in small amounts, employing those agents that assist the functional power of the stomach and intestine, as, for instance, the simple bitters, the mineral acids, pepsin, pancreatin, ox-gall, and, when possible, the animal gastric juice. Attention must be given to stimulating the general innervation; that is, to applying the measures referred to on p. 514. Possibly benefit may follow counter-irritation or hot fomentations over the hepatic region, and, above all things, in prescribing good ventilation or open-air life.

ACUTE NON-SUPPURATIVE HEPATITIS

As a result of septic and toxic causes of various kinds an inflammatory reaction of the liver is established which, in mild cases, is with difficulty differentiated from acute congestion. As the inflammation varies in cause, so it does in the morbid changes which are produced in its course. It is an affection commonly seen in the tropics, rarely in the northern climates, unless are included the focal necroses, as those of typhoid fever, the milder cases of acute yellow atrophy, and other infections and intoxications. When the temperature is high, inflammation may be predicted; but when there is but slight elevation, congestion. Even this rule fails in acute yellow atrophy and some other conditions.

The treatment is based first upon removing the cause; second, in relieving the local condition; third, in combating the effects upon the other viscera. As to the cause, colonic lavage should be practised in case of colitis, quinin given in malaria, diuretics and diaphoretics and purgatives in puerperal eclampsia, and so on. As regards the local condition, the rules of treatment are like those which apply in acute hyperemia. General depletion by purgatives and, locally, wet cupping, or the application of leeches, are of service. Just why local blood-letting depletes the underlying viscera may not be explained, but the practice is not without benefit. Direct withdrawal of blood through the aspirating needle sometimes produces great relief, although dangerous hemorrhage has sometimes resulted from injury to the vena cava or other large vessels. Leeches applied to the anus are an old and doubtless useful practice; ice may be applied over the liver if it proves comforting to the patient. In the care of the other viscera is included the systemic treatment; equalizing of the circulation by full warm baths, lowering of cardiac and arterial tension by aconite, composing the nervous system by chloral, relieving the digestive tract by mercurials, salines, and other purgatives, abstinence from food, and colonic lavage are the measures most commonly employed.

DEGENERATIONS RESULTING FROM INFECTIONS AND INTOXICATIONS

Degenerations resulting from infections and intoxications are numerous and not to be classified here.

In general infections pathogenic micro-organisms may reach the liver through the hepatic artery, or through the portal vein, particularly in diseases affecting the abdominal viscera. The intoxication may be general or gastro-intestinal in origin; more often the latter. In fact, most liver diseases result from agents reaching it through one of these channels.

Fatty degeneration of the liver, it is true, may follow an imperfect oxygen-supply as well as result from the causes above mentioned. Excess in the use of alcohol and the introduction of poisons such as phosphorus, arsenic, carbolic acid, etc., and the retrograde changes such as occur in tuberculosis, the grave anemias, and other cachexias, are the most important factors at work in inducing true fatty degeneration. The excessive accumulation of fat in the substance of the liver follows the taking of large amounts of fatty foods and forced or voluntary inactivity. The course depends upon the removal of the cause, upon the character of diet, and upon the extent of oxygenation. In those who are victims of overindulgence, improvement will readily follow from denying alcohol and fat-making foods, limiting the patient to proteids in moderation, the fruits and green vegetables in sufficient amounts. An active life should be gradually taken up when practicable, and when not, massage and Swedish movements should be substituted. There are no special measures of treatment in the more serious types of fatty degeneration save those general rules which apply to the treatment of functional disturbance of the liver; otherwise, the general habits, diet, and remedies which are found to improve the functional activity of the liver may be of some use in relieving patients who are victims of degeneration. The régime practised at Carlsbad, Homburg, Vichy, and other spas is attended by improvement when the tissue change is not too far advanced.

Amyloid degeneration of the liver should be treated, first, by removing the cause; second, by measures likely to improve the general condition of the patient and increase the functional activity of the liver. Chronic suppuration is now less commonly responsible for amyloid changes owing to the prompt drainage employed in treating pus cases. Tuberculosis with suppuration continues to be the most fruitful source of the trouble. It is known to follow late syphilis without suppuration, and there is some reason to believe that it occasionally results from dysentery, gastric ulcer, chronic cachexias, and, possibly, malaria and some of the chronic intoxications. As the removal of the cause, when practicable, is of first importance, accumulations of pus should be drained, dead bones removed, and syphilis thoroughly treated by mercury and iodin. Potassium iodid should be used with caution when the kidneys are also involved in amyloid disease. These remedies are powerless to affect the amyloid tissue, but are used to prevent an advance of the disease. An open-air life and a diet rich in nitrogenous foods are advised; also the taking of iron, arsenic, and the bitter tonics. The diarrhea which occasionally develops is intractable, and for that reason, in case of constipation, care must be observed in the use of laxatives.

Pigmentary degeneration of the liver occurs in rare cases of anthracosis; more often in chronic malaria with deposit of blood-pigment in the degenerated liver-cells and also in hemochromatosis. In malarial cases the patient should be treated for the removal of the exciting cause; hence quinin, arsenic, change of climate, and special attention to nutrition should be successful in preventing the further development of hepatic trouble. Not infrequently the liver remains incompetent, so that the course recommended in functional insufficiency becomes necessary. The nature of hemochromatosis is not well understood, and as the hepatic change is associated with a similar process in the spleen and pancreas, with iron-free pigmentation of the skin and other tissues, it is apparent that the process is a systemic one. The *diabète bronzé* of Hanot and other French writers appears to be a later development of the affection with marked pancreatic changes. The treatment is empiric and symptomatic, except so far as related to those cases associated with diabetes. When glycosuria develops, it calls for the dietetic and other methods of treatment usual in diabetes.

Leukemic Degeneration of the Liver.—The treatment may be dismissed by saying that it is that of leukemia. The administration of arsenic, especially hypodermatically, in the form of cacodylate of soda (0.30 to 0.60—gr. v to x) or atoxyl (10 per cent. solution, 0.30 to 0.60—♏ v to x), is to be advised. At least temporary benefit follows the cautious application of the Röntgen rays, not only over the region of the liver, but over the spleen and other regions especially involved.

Acute yellow atrophy of the liver, generally regarded as a fatal disease of toxic or infective origin and great rarity, has of late attracted unusual attention. It is found that some cases die with only a faint icterus and without marked decrease in the size of the liver.. It affects a wide variety of tissues, including the brain. It usually begins as a mild jaundice and ends as icterus gravis. There are reasons to believe, from subsequent postmortem findings, that some cases end favorably, although the question remains in doubt. It is known that some cases presenting the symptoms of intense intoxication resembling deep uremia are proved at autopsy to be really instances of atypical acute yellow atrophy. Aside from empiric and symptomatic measures, the best treatment known is that directed against acidosis and other grave autointoxication. This includes a thorough emptying of the intestine, colonic lavage, intravenous and subcutaneous normal saline and alkaline injections, sweating, and inhalations of oxygen gas. Vomiting should be controlled by gastric lavage and rectal alimentation should be resorted to.

ABSCESS OF THE LIVER

The course of acute hepatitis depends somewhat upon whether it is the result of, first, dysentery, including amebic infection; second, of septic infection of the digestive tract other than dysentery; third, of infection of the biliary tract; and fourth, of general infection.

Abscesses resulting from acute hepatitis may be single or multiple, large or small, and all are susceptible of the complication of rupture, either externally or internally; that is to say, through the abdominal wall, into the abdominal cavity, or through the diaphragm. When acute hepatitis has progressed to the stage of abscess formation, the treatment becomes, of course, strictly surgical. The medicinal treatment is, however, undoubtedly of service in the non-suppurative stage of acute hepatitis, for by increasing the resisting power of the organ it may be possible under favorable conditions to abort suppuration.

We may attempt to improve the general circulation through the liver, and thus, by increasing the blood-supply, raise the resistance of the part. This is best accomplished by the application of hot fomentations. On the other hand, the hyperemia of the liver may be relieved by applications of cold or by local blood-letting, either by means of the wet cups or leeches applied over the hepatic region; and the result is favored and the tension of the organ is relieved by the use of purgatives. When it is possible to discover the nature of the infection, the immunity may be increased by suitable opsonic treatment, and at times by the introduction of an antistreptococcus serum. Coincidently it would be advisable to administer nuclein. This may be done by the internal administration of brewer's yeast (fresh), in tablespoonful doses, two or three times a day. Some years ago it was believed that septic cases might be advantageously treated by intravenous injections of collargol in doses of 0.5 to 1 c.c. Too much was expected of this method, and it therefore fell into disuse, but it cannot be said that it is entirely without value. Cases of amebic abscess of the liver sometimes end favorably without operative procedure as the result of extension through the diaphragm and a subsequent discharge through the respiratory tract. I have seen several cases of this sort showing the characteristic "anchovy sauce" expectoration, and some of them made a perfect recovery. The treatment should include a liberal diet, with due regard to the primary digestion, while requiring the patient to keep at rest and to live in the open air, according to the established method of dealing with cases of pulmonary tuberculosis. When treating cases of acute dysentery, it should be borne in mind that by the proper administration of ipecacuanha, and by the skilful employment of colonic irrigation, the disease may be shortened in its course and the hepatic involvement may thus be aborted. When patients who suffer from dysentery, or from general infection, present evidence of congestion or inflammation of the liver; it is wise at once to begin the abortive measures of treatment mentioned.

CHRONIC INTERSTITIAL HEPATITIS—CIRRHOSIS OF THE LIVER

Of the various forms of hepatic cirrhosis there is one condition in common, that is, the degeneration of the parenchyma and its replacement by ingrowing connective tissue. The peculiarities in the distribution of this connective tissue give in part the ground for the anatomic classifications. In some respects it is convenient to establish a classification based on etiology, but neither method is altogether satisfactory. It is common to find a confusion of morbid structural changes which renders it difficult to classify anatomically a given case. There are, however, certain distinct types of cirrhosis generally recognized, as follows:

First, the atrophic or multilobular form, the so-called hobnail liver, in which the organ is frequently diminished in size, often associated with marked fatty degeneration, in which ascites develops, and in which jaundice is ordinarily absent.

Second, the hypertrophic, or unilobular cirrhosis, sometimes called biliary cirrhosis, in which the organ is often enlarged, with inflammation of the minute bile-ducts, not infrequently complicated by a multilobular cirrhosis. There are several forms of this type of the disease.

Third, Hanot's cirrhosis, apparently a distinct variety of the biliary type, associated with enlarged spleen, slowly increasing jaundice, often slight in degree, absence of ascites, the presence of temperature and gastro-intestinal complications, and having a slow evolution.

Fourth, cirrhosis due to stasis in the hepatic veins—the liver of chronic congestion, or the so-called nutmeg liver. The organ is enlarged, pigmented, shows marked fatty changes, is often accompanied by moderate cholangitis, and, therefore, jaundice. Ascites appears, following in the train of portal obstruction.

Fifth, from perihepatitis with extension through Glisson's capsule; often, as shown by Kelly, forming a part of a multiple serositis, and often tubercular in origin, sometimes resulting from syphilis, at times of unknown etiology.

Alcohol plays an important but undetermined part in the etiology of hepatic cirrhosis. This is especially true of the multilobular and unilobular forms, but it is known that many cases develop in abstainers from alcohol; the disease apparently depending upon the presence of some other intoxicant. The gastro-intestinal tract is thought to harbor the agents which produce these toxic substances, be they chemical or bacterial. Micro-organisms may have a direct effect in producing a chronic hepatitis, or an indirect effect in the production of toxic substances which induce the morbid change. Arteriosclerosis proves a contributing factor through limiting the supply of oxygenated blood, and a like result may follow passive venous congestion from chronic thoracic disease. Those influences which lead to the oncoming cholangitis are to be counted. Finally, must be included those factors which produce perihepatitis.

It is not difficult to construct a rule of living which would prevent the development of certain types of cirrhosis of the liver. One may even provide a regimen which will prevent the advance of the disease when it is once established; but it is hopeless to expect that any treatment will cure an affection which includes the destruction of the parenchyma of the liver and its replacement by comparatively functionless tissue. It is true that cirrhosis sometimes appears in those who apparently lead hygienic lives—cases in which the disease follows the infections, or in which intoxication arises from unknown and unsuspected sources. It is apparent that the intemperate use of alcohol, especially the unripened and poorly made distilled liquors, is injurious; wines, according to Lancereau, are more harmful when made artificially dry by the use of plaster-of-Paris; even beer at least predisposes to the affection.

It will thus be seen that in the treatment of hepatic cirrhosis alcohol should be forbidden, together with those condiments, spices, and savors used in preparing rich foods and known to be overstimulating to the liver. The primary digestion should be kept in the best possible condition and should not be overtaxed by unwholesome foods nor by overeating. Functional and other diseases of the stomach and intestine should be treated according to approved methods. The bacterial growth in the intestine should be minimized by the occasional use of calomel, gray powder, or proto-iodid of mercury, and the frequent employment of purgative mineral waters. Besides this the colon should be cleansed frequently by colonic lavage with harmless antiseptic solutions. For this purpose one may use boric acid 4 c.c. (ʒj), ichthyol 4 c.c. (ʒj), thiol 4 c.c. (ʒj), or potassium permanganate 1 c.c. (gr. xv) to the liter (Oij). These solutions should be hot and from 2 to 3 liters introduced at one time, so as moderately to distend the colon. While only mildly antiseptic, these solutions have a soothing and wholesome effect upon the mucous membrane of the part. The cirrhotic liver is always incompetent, and the extent of physiologic strain to which it can be safely subjected is therefore limited. This statement applies to the general activity of the patient as well as to the diet allowed him. Only moderate benefit can be expected from any method of treatment, and the resulting improvement will shrink in proportion as the disease of the liver advances. The general rules of management in cirrhosis are like those advised in the treatment of hepatic inadequacy (page 505) of functional origin. If good is found to result from opotherapy, it should be in cases of this sort.

Opotherapy.—According to reports, a distinct advantage is gained by introducing, per rectum, 30 to 60 c.c. (℥j to ℥ij) of finely macerated pork liver from recently killed animals. The glycerin extract may be used instead of the fresh gland. Personal experience with this treatment is inconclusive, and it can hardly be said to have become well established as a therapeutic measure, although it holds some promise. Opotherapy has met, in France, with considerable success. J. Teissier, Gilbert and Canot, and others regard the method as of real value. The liver of animals is dried, powdered, and administered in milk, either by the stomach or per rectum. In biliary cirrhosis some measures must be adopted for the relief of symptoms induced by the accompanying jaundice.

Ascites is often related to the late stages of hepatic cirrhosis, but it occasionally fails to appear because of abundant anastomosis of the portal with the systemic veins. The symptom may be produced with little or no cirrhosis of the liver, in which case it may result from cachexia, portal compression, peritonitis (general or circumscribed), perihepatitis, syphilis, cancer, or other tumors of the abdomen, or as a step in general anasarca. The accumulated fluid may result from either exudation or transudation and sometimes from both. In cirrhosis of the liver, as in other forms of portal stoppage, the mechanical obstruction is the most important factor, but with this is often associated a pathologic state of the peritoneum which interrupts absorption. In a proportion of cases a low grade of peritonitis is a contributing factor, as in syphilitic and other forms of perihepatitis, in cancer, and in various abdominal tumors. Treatment by drugs is unsatisfactory in those cases in which mechanical obstruction exists; also, of course, in malignancy and other inoperable growths. On the other hand, in some forms of cachexia, or in chronic congestion from thoracic disease and in syphilis, drugs may accomplish much good. In any case of ascites it is well to be sure that the systemic circulation is free and the blood-pressure at the proper standard. If necessary, digitalis, strychnin, or other cardiac stimulants should be administered; also massage and superficial friction, brine baths, and other measures to improve capillary circulation should be employed. When there are cardiac and renal complications, benefit sometimes follows carefully regulated purgation together with diaphoresis and diuresis. In ascites connected with chronic congestion of the liver, pil. hydrarg., 60 c.c. (gr. x), followed by a full dose of the magnesium sulphate, sometimes has the effect of greatly increasing the output of water, and thus relieves the dropsy. The hydragog purgatives, like elaterium (elaterin), from 0.00324 to 0.0081 gram, may be used guardedly, and apocynum in doses of 5 drops of the fluidextract, three or four times a day, is sometimes very efficient through its action as both a purgative and diuretic. In all syphilitic cases iodids and mercury must be used in addition to other treatment. When the obstruction is from hepatic cirrhosis, medicinal measures are of little value; and when the fluid accumulates so much as to embarrass the function of the abdominal and thoracic organs, it should be drawn off through a trocar. Many years ago Flint taught that it was good practice to tap early and repeatedly, and this view is now generally adopted. One case I tapped at intervals of three weeks during a period of more than two years without apparent injury, and this in a case which failed to be benefited by a successfully performed Talma's operation. Faradization of the abdomen has been advised, and of late the introduction of sterilized oxygen following the withdrawal of fluid has been recommended, but neither of these measures has achieved a reputation.

Although most writers agree with Rolleston that the prognosis is bad in cirrhosis of the liver, since the disease is incurable, we should not forget that in a small minority of cases the patients recover, so far as symptoms are concerned. This point is insisted upon by Débove, who shows that although in these cases the liver remains permanently sclerosed, yet there is a sufficient amount of functioning parenchyma to permit the patient to escape the ordinary symptoms of hepatic cirrhosis. Such fortunate patients must, of course, consent to live within relatively narrow limitations. When the disease comes to a standstill, a careful investigation of the metabolism should be undertaken so as to discover a diet which may be safely followed. That is to say, we should find the relative proportion of proteids, carbohydrates, and fats which the patient may ingest with safety. Having ascertained these facts, and having in mind the number of calories that must be assimilated to maintain the body-weight, it will become comparatively easy to prescribe the amount of physical or mental activity which a patient may take without danger.

SYPHILIS OF THE LIVER

In the early stages of syphilis the liver is not infrequently found large and tender, the result of congestion and swelling of the parenchyma. The organ undergoes functional depression, the amount of bile discharged is lessened, and occasionally a slight icterus is observed. It is in the later stages of the disease, however, sometimes years after the initial lesion, that important visceral lesions develop, among which hepatitis is to be counted. In many instances cases closely resemble those of hypertrophic cirrhosis; that is to say, together with a large liver occur jaundice, ascites, and metabolic disturbance. In other cases the organ is deformed from perihepatitis and involvement of the capsule of Glisson. Irregularities from deep scars, secondary to gummata, may be felt on palpation; occasionally the most striking feature is the enormous size of the liver. These cases should be treated by inunctions of mercury, and large doses of potassium iodid, long continued, possibly by "Salvarsan," together with such general management as is required by any insufficient liver. It is emphasized that the specific treatment should be thoroughgoing.

Unquestionably not a few patients who are the victims of late syphilis are believed to be suffering from cirrhosis of the liver, and hence they miss the opportunity of recovery that proper diagnosis and treatment would offer. It is a very remarkable fact that the liver may be most extensively involved with what at first thought would appear to be a hopeless disease, and yet under sufficiently vigorous treatment may so improve that, after a few months, the organs show practically no evidence of disease upon the most careful physical examination. Likewise the function of the organ may be largely restored.

JAUNDICE

Jaundice must be considered merely as an important symptom. It may arise from disease of the liver or its appendages, and from hemolysis; such are the cases of so-called hematogenous jaundice. There is good reason for believing that in the latter the jaundice is sometimes really associated with disease of the liver and bile-ducts. Instances of this occur in extensive extravasation of blood and in certain toxic conditions which excite hemolysis. Jaundice sometimes follows intense emotional excitement; it may result from starvation; at times it accompanies menstrual disturbance; it frequently follows extensive burns of the integument; but in none of the above instances are we quite satisfied as to the precise steps of the pathology. Polycholia was once believed to account for jaundice accompanied by the appearance of bile-pigment in the stools, but this is a misconception. Sometimes, it is true, jaundice is associated with an excessive discharge of bile-pigment in the stools, but at the same time the amount of bile salts may be greatly reduced, circumstances which may follow an obstruction in some important biliary duct while others remain patulous. When the jaundice is very slight, the skin may show a faint tint without a noticeable appearance of the pigment in the urine. It has been shown that bile is only formed in the parenchyma of the liver, so it is clear that jaundice results either from disease within the liver or from obstruction to the outflow of bile through the biliary ducts.

Jaundice in the new-born may be septic in nature, due to umbilical infection, or may result from the various factors active in producing the symptom during the other periods of life. Not infrequently these cases are associated with marked hemolysis, at other times with mild infection of the bile-ducts. A slight cholangitis is the most common cause of the disturbance, as in Winckel's disease, and may be general, or limited only to certain tracts of the system of the biliary ducts, and is often associated with a duodenitis. The light forms of epidemic jaundice are usually of this kind, and the more severe type of infective jaundice, known as Weil's disease, which occurs either as sporadic cases or in epidemics, is associated with cholangitis.

Icterus gravis should not be regarded as a specific disease, but as a term applied generally to severe types of toxemic jaundice, and is to be distinguished from the special disease known as acute yellow atrophy of the liver. As has been stated, death may occur in the latter with but slight appearance of jaundice, although, as a rule, the icterus is intense and the obstruction in the small bile-radicals almost complete. Jaundice is a frequent accompaniment of cholelithiasis, but, on the other hand, there may be serious disease of the gall-bladder, with so little disturbance of the liver or hepatic duct that jaundice is entirely absent. When jaundice depends on cholangitis associated with gastroduodenitis, the latter condition should receive special attention. The bowels should be opened with an alkaline saline water like Carlsbad, or by sulphate of magnesia dissolved in a large quantity of hot water. This is better tolerated by the stomach if a spoonful of milk of magnesia is stirred in the solution. Comfort is obtained by gastric lavage followed by a bismuth mixture; small doses of ichthyol are useful, and if the gastric juice is strong, the acidity should be reduced by copious drafts of alkaline water, reinforced by the light carbonate or the milk of magnesia. Sodium phosphate may be given each morning to continue the relaxation of the bowels. The diet should be greatly restricted, fluid in character, and unstimulating. For this purpose gruels, the purées, and milk with Vichy water should be selected. The patient should be kept at rest and, with convalescence, the usual diet should be gradually resumed, care being taken not to overtax the digestion. In the jaundice accompanying cholecystitis and cholelithiasis with cholangitis, the treatment embraces that suitable to these affections. When jaundice accompanies toxic or infective disease of the liver, the attempt must be made to remove the cause when possible; and here much attention must be given lest the liver is overtaxed. The diet must be of the lightest character, the tendency toward intestinal stasis removed, and colonic lavage is indicated. Following large extravasation of blood or in conditions accompanied by marked hemolysis there may result an increased viscidity of the bile, which of itself tends to produce obstruction. This condition, with catarrh of the smaller bile-ducts, exists in some of the inflammatory conditions of the liver. Under such circumstances the treatment of the jaundice should include measures which tend to dilute and increase the outflow of the viscid bile. That is to say, water should be given in large amounts, aspirin and the sodium oleate given in small doses regularly, a mercurial followed by a saline should be administered every two or three days, and the alkaline purgative waters taken in large amounts very early in the morning. Hathorne or Vichy water among the milder waters, Carlsbad, Friedrichshall, or others of the more actively purgative, are to be selected according to the laxative action required. The hot wet compress or the hot affusion over the region of the liver, and other measures which are directed toward the relief of the underlying condition, have a favorable effect upon the jaundice. Enteroclysis is of use in increasing the water in the blood, and if the jaundice is intense and threatens to assume a grave type, the subcutaneous injections of normal saline solution, repeated daily, may assist in lessening the intoxication, in part through the increased diuresis which it induces. The full hot or steam baths which are advisable to assist in unloading the skin are sometimes useful in relieving itching. Occasionally hot baths increase the latter symptom; then, for the comfort of the patient, a calamin wash may be applied.

If this fails, one may try sponging with dilute aromatic vinegar; or with a solution of menthol (0.60 gm.—gr. x) in dilute alcohol and water (each 15 c.c.—ʒiv), or with resorcin (1 gm.—gr. xv), boroglycerid (2 gm.), and brandy (30 gm.—℥j).

Constipation sometimes occasions much inconvenience in jaundice, and when not relieved by the simple measures hitherto mentioned, it is well to use one of the stronger saline purgative waters, like Hunyadi, Villa Cobras, or Abilena. If the salines are ineffectual, such vegetable remedies as cascara with a little nux vomica may be tried, or a combination of colocynth compound (0.12 to 0.30 gm.—gr. ij to gr. v) and extract of physostigma (0.015 to gr. ¼). The latter drug is of use in stimulating peristalsis, and is often successful when the colon is in a state of atony. Inspissated ox-gall in doses of 0.06 to 0.12 gm. (gr. j to ij) may be used with any of these. Diarrhea, although rarely present, is sometimes troublesome, and depends upon a putrefactive decomposition of the intestinal contents, arising from a lack of biliary salts. Under these circumstances intestinal antiseptics are useful, such as salol, beta-naphthol, beta-naphthol-bismuth, sulpho-carbolate of soda, or the salicylate of bismuth. The glycocholate of soda or the equivalent of inspissated ox-gall sometimes produces good results. In other instances greater relief follows the washing of the colon with an antiseptic solution, to which astringents may, if necessary, be added. These measures are also useful in controlling the flatulence which is often an annoying symptom. Insomnia may result from the pruritus, or, again, from the more direct effect of the intoxicants upon the brain. More often there is hebetude and somnolence. It is best to avoid opium as a remedy for insomnia, using in place chloral, chloralamid, amylene hydrate, or the bromids. These same remedies are often useful in overcoming the headache of jaundice, but occasionally it is wise to use small doses of antipyrin, which may well be combined with monobromated camphor and caffein. If the stomach is intolerant and the bromids are called for, it is advised to use the strontium salts in preference to the other.

Icterus gravis, from its accompanying serious intoxication, disturbs the cerebrospinal, circulatory, and urinary apparatus. Chloral, chloralamid, antipyrin, lactophenin, and rarely opium may be demanded to quiet the cerebrum, but the danger of coma must be borne in mind. Nux vomica, camphor, or ether may be needed to support the circulation, and calomel, diuretin, or juniper may be required as diuretics. In all cases of jaundice, especially in the more toxic types, the kidneys are affected unfavorably.

Weil's disease should be treated after the manner of enteric fever. The hot bath is indicated for relieving nervous symptoms, but the tepid or even cold tub baths are not only useful in relieving temperature, but also improve the general condition of the patient. Colonic lavage is especially called for and the subcutaneous injections of a normal saline solution have proved of distinct benefit.

DISEASES OF THE BILE-PASSAGES

In cholangitis there is inflammation of the lining mucous membrane of the biliary passages which may involve both large and small ducts, or may be limited to certain regions of the biliary tract. Sometimes it is associated with cholecystitis, but not necessarily so. The character of the disease depends upon the nature of the infection and the resisting power of the patient. While at times it is mild in degree, producing only moderate swelling and occlusion of a small proportion of the biliary radicals, at other times it is intense and purulent in character, leading to multiple abscess formation. Between these extremes there are various grades of severity. In origin it is either toxic or infective and its course is very variable. In certain specific infections, like typhoid, pneumonia, or yellow fever, its decline is synchronous with that of the general process. In other infections the disease shows little tendency toward recovery. At times the infective agents seem to limit their attack to the biliary passages alone, other regions escaping. When the disease results from toxic causes, the cholangitis usually subsides soon after the disappearance of the exciting cause. This desirable result is sometimes prevented through the intervention of infection, which complicates and prolongs the disease process. The affection is sometimes secondary to duodenitis, causing obstruction, sometimes to cholecystitis and cholelithiasis. It not infrequently happens that the treatment must include that of the latter affections.

Cholelithiasis is a result of cholecystitis; that is to say, gallstones are formed through inflammatory exudates from the surface of the lining of the diseased gall-bladder, and occasionally a calculus develops in one or more of the biliary ducts, deep in the substance of the liver, apparently from local disease of the duct which incloses it. It is possible that the calculus thus formed, escaping from the inclosing tube, may find its way with the descending bile into the gall-bladder. It is doubtful, in case this should occur, if the gall-bladder would be harmed by the presence of this occupant.

Cholelithiasis is preceded in the great majority of cases by **cholecystitis,** and in many instances is accompanied by it. The attacks of hepatic colic are usually produced by the spasmodic contraction of an inflamed gall-bladder, forcing the gall-stone into the cystic duct or the choledochus. It is possible that attacks identical in character may follow the spasmodic contraction of the irritated gall-bladder without the presence of any stone whatever. Small stones may find their way into the cystic duct and pass through the choledochus without inducing serious distress. As a rule, the stone remains as a relatively innocent tenant of the gall-bladder until such time as cholecystitis is re-excited, making the gall-bladder irritable, and this irritation, setting up spasm, forces the stone into the cystic duct, where it often engages, either at the entrance thereto or at a point proximal to the junction of the cystic and choledochus ducts. Remaining a source of irritation in this region, the stone is a cause of more or less continual suffering and, by obstruction often leads to stasis of bile in the hepatic duct, to cholangitis, and to jaundice. In the region of the liver overlapping the gall-bladder a sort of sympathetic congestion with localized cholangitis and moderate jaundice is known to occur even when the hepatic duct and the majority of the bile-passages are unobstructed. While the disease is believed to have its origin through the intermediation of infection, there are undoubtedly numerous predisposing factors which are of importance in etiology and a guide to treatment. Among these are gluttony, obesity, laziness, child-bearing, tight lacing, and advancing age. The disease is most frequently seen in females of middle age or older, who are fat, good livers, constipated, physically inactive, and habitually tight-laced.

The treatment of gall-stone has received wide consideration, and of late has become more generally surgical. From what has been said, it is obvious that very much can be done in the way of prevention and cure by hygiene and medical treatment. While asserting this, it is admitted that cholelithiasis is one of surgery's most legitimate fields. In suppurative angiocholitis very little can be done either by medicine or surgery. It is a waiting matter, and treatment is limited to sustaining the patient, on the one hand, while avoiding overtaxing the liver on the other, and bringing to bear such general rules as apply in the treatment of simpler forms of cholangitis. In suppurative cholecystitis the field belongs to the surgeon. The management of simple cholangitis and cholecystitis is much alike. Predisposing factors, to some extent, can be and should be obviated. The patient should live more in the open air and have more active exercise, with the assistance of a medical gymnast, if necessary; should have the diet restricted so as to avoid superalimentation; alcohol must be shunned, the eating of meats and fats decidedly limited, and the carbohydrates decreased. He should limit himself to a little bread, milk, fresh fish, perfectly ripened fruits, and very fresh vegetables, following, in fact, the dietary advised in functional incompetence of the liver. Women after childbirth should take measures to prevent the too frequently remaining lax abdomen, and should discard the practice of wearing the lower garments supported from the waist. Constipation must be overcome and the alimentary tract kept in the best practicable condition. Alkaline and carbonated waters should be drunk freely and frequently. Tea, coffee, and chocolate are best omitted, substituting therefore the teas from aromatic herbs or hot lemonade. By the Turkish bath or its substitutes the skin with benefit may be kept active, and the drainage of the bile-passages may be favored by a course at one of the mineral spas. Waters may be selected which are useful in stimulating the unstriped muscle-fibers of the biliary ducts, besides removing sources of irritation from the intestine. Some of these waters apparently have a specially favorable action upon the biliary apparatus. Such are several of the springs of Saratoga, those of Bedford, Las Vegas, various sulphur springs, and many others of this country, and abroad the waters of Carlsbad, Homburg, Vichy, Contrexeville, Harrogate, are a few of a large list that might be recommended.

In inflammatory affections of the liver, especially in cholecystitis and cholangitis, Reichmann recommends giving methylene-blue in 0.03- to 0.05-gram doses three times a day. He considers that the drug passes quickly through the organ and has a destructive action upon bacteria. In this connection it should be noted that the intermittent and imperfect elimination of methylene-blue in the urine is considered by some French observers as a sign of functional deficiency of the liver, as it is known to be of the kidneys.

Hexamethylenamin (0.3 to 1 gm.—gr. v to gr. xv) is recommended in subacute cholecystitis because of its antiseptic effect; for the same purpose a combination of sodium salicylate and sodium benzoate (of each 0.6 gm.—gr. x) is often very efficient. Magnesium salicylate (1 gm.—gr. xv) may serve equally well, and as an intestinal antiseptic it is to be preferred. When there is a complicating duodenitis, it is best to select bismuth salicylate. It should be given in a mixture, and acts best associated with an equal amount of salol (0.3 gm.—gr. v), shaken up with mint-water.

The cure at Carlsbad is celebrated, and a large number are there relieved, but good results cannot be expected in those cases in which treatment is properly surgical. It is not alone the waters which benefit, but also the life and hygiene of the patient sojourning away from home. The plan of treatment differs somewhat with different physicians. It usually includes relative increase in exercise, decrease in the quantity of food taken, frequent small meals, and the more abundant drinking of water. In addition, hot fomentations or peat poultices are locally applied, besides which there are courses of medical gymnastics and baths. The secret of the matter lies in the successful enforcement of hygienic discipline. In mild inflammatory conditions, which improve readily as soon as good biliary drainage is secured, this treatment is all that is necessary. There is a class of patients who are constantly predisposed to biliary disease, a fact which seems to depend upon some peculiarity in metabolism. We find the analog of this in individuals who are predisposed to tonsillitis, bronchitis, catarrhal gastritis, and asthma. So long as these people live in the open air, eat moderately, and have active elimination, they enjoy good health, and, conversely, with idleness, indoor life, and improper eating they develop a feeling of languor, the urine becomes over-acid, and the cutaneous and alvine evacuations insufficient; whereupon the familiar symptoms reappear. Under these circumstances not a few suffer from hepatic congestion and imperfect drainage from the bile-ducts as well as from an irritable state of the gall-bladder. There are some who suffer from the re-ignition of cholecystitis under these circumstances. The systematic taking of Glauber's salts, sodium phosphate, and an occasional mercurial may tide over the attacks, partly from systemic effects, partly because of the resulting stimulation to the biliary ducts and intestine; but such patients are more liable than others to infection of the gall-bladder and consequently more serious cholecystitis.

Ewald and others advise under these circumstances the use of eunatrol or sodium oleate, which is of unquestioned value. It seems to be more effectual in combination with aspirin, as recommended by Bauermeister. Experiments appear to show that the glycocholic acid of bile increases the solubility and prevents the precipitation of cholesterin. The bile collected from the fistula of patients operated upon for cholelithiasis is, according to Austin, deficient in glycocholic acid. It may be inferred that there is a deficiency of glycocholic acid in the bile during cholecystitis, and that this accounts for the precipitation of cholesterin in the formation of gall-stones. There is some ground for the belief that normal bile favors the solution and disintegration of calculi in the healthy gall-bladder. At least Vaughan Harley has shown this to be true in dogs. These facts lend support to the use of the glycocholate of soda as a remedy not only in the prevention, but also in the treatment of cholelithiasis. We lack collected data on the results of this method, but it appears to have a definite field of usefulness.

Unfortunately in most cases of cholelithiasis the circulation of the bile through the gall-bladder is obstructed, which may prove a barrier to the action of the glycocholic acid. In those cases in which there is an active inflammatory process, the object of treatment is to dissipate the congestion, relieve swelling, and bring the patient into a state where drainage may be reëstablished. In other words, the patient should have complete rest in bed, the digestive tract should be opened by calomel, followed by a saline, the colon should be washed out, and vomiting, if present, treated by gastric lavage. The latter method has a favorable action upon the biliary apparatus, besides relieving the vomiting. In gastric lavage it is well to employ a solution of sodium bicarbonate, 2 c.c. to each liter of warm water, to which may be added sodium sulphate in like proportion. A feeble astringent solution (fluidextract of hamamelis, 4 c.c.; warm water, 1 liter) is more successful when the gastric mucosa is especially irritable. Ewald in such cases advises the use of a silver solution (1 gm. to 1 liter of water).

There is often encountered a hyperchlorhydria or a mild catarrhal gastritis, frequently pyloric spasm, or, sometimes, gastric atony in these cases. The biliary symptoms are aggravated by the slightest stagnation of gastric contents or by marked disturbance in gastric chemistry. For this reason it will be seen that lavage, intelligently employed, is a useful measure in the treatment of inflammation of the biliary passages. In the beginning of the attack food should be omitted, and then milk in small quantity should be given with Vichy water. Later, varied preparations of milk, the thoroughly cooked gruels, or egg-albumen and expressed beef-juice may be added. Hot fomentations, poultices, and the hot tub-baths are very useful at this time. As the patient improves, as shown by the increased coloring-matter in the stools and a decrease of bile in the urine, he should be moved into the open air by means of a wheel-chair, given passive exercise, and the diet gradually increased. It is a common error to believe that the pain and obstruction in these cases result directly from the gall-stone; whereas, in fact, they depend upon inflammation. Indeed, these symptoms appear before gall-stones are formed, and occasionally even after their removal by surgical means; and it is a well-known fact that a large proportion of gall-stones give rise to no recognized symptoms. This explains the dictum of Riedel that there are 2,000,000 people in Germany who have gall-stones and only about 100,000 who have any symptoms thereof; in other words, the smaller number suffer from a superimposed inflammatory process, which must be held accountable for the suffering; and the relief usually experienced after surgical intervention is attributed to the establishment of thorough drainage and to cure of the inflammation incidental to the removal of the calculus.

When the irritation is so great as to produce spasm of the gall-bladder and ducts, an attack of hepatic colic supervenes. The pain of such attack may often be relieved by the prolonged hot bath. This lessens internal congestion and induces relaxation, but should it fail, morphin or codein may be used hypodermatically as a temporary measure. It is a great mistake to continue the use of anodynes when the pain may be relieved by hot baths, packs, lavage, salicylic acid, or other antispasmodics. Aside from the danger of inducing the morphin habit, the general condition of the patient is disturbed and the digestion especially deranged. Slight causes often re-excite the pain, therefore great care must be exercised in nursing the patient. Violent efforts, the taking at one time of too much cold water, overeating, or efforts at defecation may prove sufficient. It is under these circumstances that olive oil is sometimes useful in soothing the duodenum and indirectly the biliary passages. A great deal of misunderstanding has arisen as to the exact rôle of this remedy. Its action has been lauded and scorned in equal proportion. It apparently has no effect upon the gall-stone nor upon the disease process in general, but it does exercise a soothing effect upon the duodenum, and indirectly the biliary apparatus, when the parts are in a state of great excitability. Reichmann recommends 100 to 150 c.c. at one time, although larger and smaller doses are preferred by others. Einhorn advised the use of glycerin, a remedy first announced by Ferraud. The acid oleate of soda, the so-called eunatrol (0.3 gm.—gr. v), given every two or three hours, is more convenient, and is apparently quite as successful. It is a common experience to find patients relieved by vomiting, doubtless because of the relaxation which follows the act, and this may explain the comfort induced by gastric lavage in these cases. When the irritation has subsided, it is well to stimulate a freer secretion of bile. As has been implied, this principle is more easily laid down than acted upon, but undoubtedly something can be accomplished. The most useful remedies are phenolphthalein, aspirin, and sodium oleate, as recommended by Bauermeister, of which about 0.3 gram may be given two or three times in twenty-four hours. It is often wise to give glycocholate of soda (0.06 to 0.12 gm.—gr. j to ij), incorporated with a few grains of extract of taraxacum, twice a day. This sometimes succeeds best as an accompaniment of the last mentioned prescription, or one may be used for a few days, to be alternated with the other. Inspissated ox-gall in 0.6- or 0.12-gram doses exercises a favorable influence, probably from the bile salts contained. Salicylic acid and irisin have some value; so also has the frequent taking of carbonated water and bland food in small quantities. The so-called vegetable cholagogs, like podophyllin, leptandrin, aloes, senna, etc., and the mercurials doubtless stimulate the motion of the biliary passages and may assist in emptying them, but have no effect in increasing the secretion of bile.

In a typical case of acute cholecystitis, with fever, vomiting, constipation, severe pain, and tenderness in the region of the gall-bladder, the following measures are advised: Place the patient in a full tub bath, very hot, irrigate the colon with hot normal saline solution, wash out the stomach with a boric acid solution, and follow this with a mixture of aspirin (1 gm.—gr. xv), bismuth subcarbonate (1 gm.—gr. xv), cherry-laurel water (4 c.c.—ʒj) added to a sufficient amount of water. Should this be vomited, and should the pain continue, give a hypodermic of codein phosphate and apply over the hypochondrium a large, hot compress and frequently renew it. As soon as it may be tolerated, give a moderate dose of calomel, and follow this after a few hours with a full dose of magnesium sulphate, given as a saturated solution and ice-cold. The bowel may be further emptied by using a large colonic irrigation. When the stomach is calmed sufficiently, administer aspirin or magnesium salicylate with bismuth, repeatedly, as may be required to relieve the pain and soothe the biliary passages.

In a certain proportion of cases the cholangitis or cholelithiasis is very acute. It is accompanied by chills, high temperature, leukocytosis, and great distress, often by severe pain. If the process is limited to the gall-bladder, jaundice may be entirely absent. Under such circumstances the general treatment should include absolute rest, a hot bath followed by a light poultice, antipyretics, and saline purgatives. Of the antipyretic drugs, there is a choice, not always to be made without trial. Sodium salicylate, magnesium salicylate, aspirin, antipyrin, and lactophenin compose a desirable list. Full doses are required, for their action is not merely to reduce temperature; often they overcome the pain, besides favoring the escape of bile. In those cases in which the symptoms do not quickly abate, drainage of the gall-bladder is called for to save life. Such emergencies sometimes arise in the cholecystitis of typhoid and other infections. When cholecystitis has continued for a considerable time, whether or not accompanied by cholangitis, it is safe to infer that a gall-stone is present, and if the case is not relieved by medical treatment, it is usually because the gall-bladder is seriously diseased, or else because the stone has been forced into and retained by the cystic or common ducts. As soon as it is concluded that one of these conditions is present, the physician should ask the assistance of the surgeon. It is not proper to settle the question without due consideration. In favorable cases of cholelithiasis the condition will subside under proper medical treatment, and the patient remain well; on the contrary, when he resumes active life, local distress and other signs of irritation may recur. If under these circumstances there is absence of jaundice, it is probable that the stone is held in the cystic duct. Then, even when the symptoms are slight, the stone should be removed. In other instances there is recurrent jaundice; then it may be assumed that the stone is in the ampulla of Vater, where, through the so-called "ball-valve" (Fenger) action, it leads intermittently to obstruction. Under these circumstances the stone should be removed.

In those cases in which the enlargement and tenderness of the liver decrease, when local and general symptoms disappear, it is advisable to continue medical treatment. If subsequently the patient suffers from chronic gastric or intestinal trouble, if he has occasional attacks of so-called gastralgia with hyperchlorhydria, gastric atony, or intestinal indigestion, even though there is an absence of the ordinary hepatic symptoms, it is to be assumed that the gall-bladder is in a state of chronic irritation which the calculus helps to keep alive, and that the symptoms of disturbed digestion arise in sympathy with the gall-bladder. Under these circumstances it is proper to resort to surgery. It is true that there are a few instances in which the walls of the gall-bladder, instead of thickening and contracting as the result of inflammation, become thin and the gall-bladder distended. This thinning process may be limited to a small area in an otherwise thickened and contracted gall-bladder. Under such circumstances there is danger of perforation. These cases, if they can be selected, should always go to the surgeon. In deferring too long the physician incurs the criticism of the surgeon. There are always a few cases in which doubt exists, and when in doubt it is safe to advise operation. Fortunately these uncertain cases are relatively rare.

SURGERY OF THE LIVER AND GALL-BLADDER

By Roswell Park, M.D.

HEPATOPTOSIS AND HEPATOPEXY

The cause of hepatoptosis is more likely to be inadequacy of the suspensory apparatus than any other. Nevertheless the liver may have been so displaced by pressure from above or around it as to assume not only a different position, but also a shape different from the normal. That distortion known as "Riedel's lobe" affects usually the right lobe, and consists usually of elongation and actual enlargement, with abnormal motility, which have caused it also to be called the "floating lobe." It is the most usual form of so-called "movable liver." On the other hand, there may be a complete downward movement of the entire organ, not in a direct vertical direction, but the anterior border, *i. e.*, the most palpable portion, moving most freely, owing to the fact that the posterior border of the liver is the more firmly attached. The right lobe, whether enlarged or not, being more appreciable, seems to move more freely than does the left. With depression of the anterior edge comes an abnormal presentation of the anterior and upper convex surface. Occasionally the whole liver seems more flattened than usual, while sometimes the transverse fissure is unusually distinct and is felt rather along the anterior surface of the right lobe.

The enlargement of the right lobe, with which Riedel's name is so often associated, is quite frequent in connection with gall-stone trouble, and any form of biliary obstruction, and its retrocession and restoration to apparently the normal size are almost invariably noted after removal of gall-stones or drainage of the gall-bladder. When a well-fitting belt is found inadequate, even when reinforced by an inflatable rubber pad or its equivalent, then surgical relief apparently is demanded.

This may consist of removal of gall-stones or whatever may be called for by the condition of the biliary passages, after which, if the difficulty pertain to the right lobe alone, it will usually be found relieved in the course of a short time. A very much enlarged lobe has been repeatedly treated by excision, which should be limited, however, to those cases in which there is great complaint of pain that apparently cannot be otherwise relieved.

Hepatopexy, or suture of some portion of the liver to the fixed surrounding walls, was first performed by Billroth, though the first complete operation for the purpose of holding up the entire liver was done in 1891 by Gerard-Marchant. The method usually adopted is to sew the anterior edge of the liver to the costal margin, or perhaps to the anterior abdominal wall. In addition to sutures, denudation of the surfaces to be brought into contact will give additional security of adhesion. In special cases this general plan has been modified, either by bringing the anterior and posterior parietal peritoneal surfaces together below the liver, or even by resection of the abdominal wall. It should be sufficient, in most cases, at least, after denuding opposed surfaces, to fix the anterior edge of the liver with tendon or well chromicized catgut to the lower thoracic margin, and perhaps to stimulate firmer granulation by the insertion of strips of gauze between the liver and the diaphragm, which may be all withdrawn through a single opening after the lapse of a few days.

SURGICAL TREATMENT OF NEURALGIA OF THE LIVER

It was the elder Pancoast who, a number of years ago, under the title of "The Antiphlogistic Touch of the Surgeon's Knife," described how certain cases of deep-seated pain were relieved by puncture with a tenotome, even where no pus nor other appreciable lesion was detected. The lesson which he taught in this regard has been neglected by the following generation, and the profession generally do not realize what relief to deep pain may often follow mere puncture by the aspirating needle. So many instances of this can be related, in the experiences of those accustomed to use it, that it would seem quite justifiable in vague cases of deep-seated pain in the liver, so-called neuralgia, to make, with every antiseptic precaution, three or four deep punctures, with the ordinary sized aspirating needle, and without any attempt at aspiration, or reference to the presence of pus. Particularly, however, in those cases where the latter is suspected, the use of a needle is given a double indication, both for what it may reveal and for its probable effect in relieving pain.

ABSCESS OF THE LIVER

Cases of hepatic abscess may be seen late when the indications for operation are so plain that the surgeon hardly feels it worth while to resort to preliminary puncture, but when the case has been under proper observation and treatment and the gradual formation of an abscess has been suspected, it is desirable after a certain time—which should be, if possible, early rather than late—to prove or disprove the suspicion. Here the method everywhere in vogue is by puncture and aspiration, but the latter should not be regarded as the final measure for relief, nor one to be lightly regarded nor carelessly practised.

In most instances there will be local indications as to the direction in which exploration should be made. Repeated punctures are justifiable in proportion to the urgency of the symptoms. These can usually be made under the freezing spray or local cocain anesthesia. Rarely is it necessary to give for this mere purpose a general anesthetic. On the other hand, when the existence of pus is practically certain and it is simply a question of its location and evacuation, then it is perhaps better to do all the work under an anesthetic, establishing the exact location of the focus by the use of the needle, and then perhaps leaving it *in situ* in order to serve as a guide for the incision and drainage which should promptly follow.

The general rule, that "pus left to itself will do more harm than will the surgeon's knife judiciously used," applies here as well as elsewhere. It applies equally to abscess within the liver or to subphrenic abscess, for which it might perhaps be mistaken.

Save in very acute cases time sufficient for the formation of protective adhesions will usually have elapsed. These may fix the liver to the diaphragm, if the abscess be near the upper surface; or, if near or pointing near the lower surface, will usually cause omental or peritoneal adhesions, which serve as a protection, and of which the surgeon may avail himself, if possible, during the operation. Abscesses occasionally are so placed that they may be opened by an incision between the ribs. When such collections of pus thus evacuated are large, the liver will shrink as the abscess cavity is emptied, and openings which were at first directly opposite to each other may be shifted a relatively considerable distance. This will depend upon the adhesions as well as upon the size of the abscess cavity. If one should make such an incision between the ribs, and then find good reason for it, it would be quite justifiable to remove an inch or two of one or more of them in order not only that the abscess cavity may be reached, but that it may be suitably drained; because such a cavity, if large, will be sometimes slow in healing and drainage may be required for some time. One must not, however, let himself be tempted to go too high without assuring himself that he is keeping out of the pleural cavity. On the other hand, in those cases where such a cavity has already perforated the diaphragm, and has produced an empyema as well, the effort must be deliberately made to open both cavities, and enough rib should be excised that this may be thoroughly done, and separately, if possible.

In most instances incision is made either just below the costal margins or close to the rectus muscle. If the peritoneal cavity be found open and without adhesions, then it must be carefully walled off with abundance of gauze. If, on the other hand, adhesions be found, it may be possible to open the abscess by the gradual process of separating them and working in between them and the lower surface of the liver. Here the exploring needle may be used, if necessary, as a precaution and in order to learn the exact location of the pus. This having been recognized, every precaution must be taken to prevent its escape into the peritoneal cavity. Aspiration may be practised here, if the pus be thin enough to run through a large needle, but it should be followed by ample enlargement of the track. The cavity thus opened must be thoroughly cleaned out. One should further assure himself that there is but one such cavity, and that pus is not present elsewhere in the neighborhood. Some operators prefer to make the opening with the actual cautery; this, however, is a refinement which is rarely necessary as a precaution. Evacuation and cleansing are to be followed by provision for drainage. If the peritoneal cavity have been kept strictly clean, and it be possible, it is a great advantage to unite the margins of the abscess cavity to those of the peritoneal incision, and thus externalize the former. When this is not practicable, free drainage must be made by the combined use of a large tube and gauze packing.

The subsequent treatment of such a case calls for daily cleansing, and insertion and changing of gauze wicking, with reduction of its amount, and final removal, all in proportion to the rapidity of the contraction and the granulating process.

All that has been said above regarding ordinary abscess of the liver applies as well to **suppurating hydatid cysts,** only these have a much more marked wall, sometimes quite thick and resistant, and will be probably much slower to heal. Instances may rarely occur where one will be tempted to make a partial or complete extirpation of such a cyst, but ordinarily one must content one's self with the measures above described, and, in addition thereto, with thorough and vigorous curetting of the entire interior surface. The more vigorously this be done, the more promptly will those granulations spring up by which subsequent closure and obliteration of the cyst will be produced.

TUBERCULOSIS OF THE LIVER

In the liver, as in other viscera, tubercular disease may assume the disseminated and miliary type or the more local expression of tubercular gumma. We have multiple gummata, which may subsequently break down either individually or in common, or which may coalesce, with or without the production of cold abscess. Primary tuberculosis of the liver is most rare; it is usually a sequent or secondary infection. It leads by itself to few, if any, recognizable signs or symptoms, but, in connection with other tubercular disease, especially visceral, it may lead to enlargement of the entire viscus, or it may furnish the later expressions of abscess, acute or chronic. In very many instances of tubercular peritonitis the peritoneum covering the liver will be seen dotted with miliary tubercles. These pursue the same course as those elsewhere within the same cavity, and develop or subside accordingly. Tubercular gumma may cause enlargement, in which the presence of pus may be suspected. The use of the exploring needle—as already described—may decide this matter. If pus be found, it becomes a surgical case; otherwise it is at least non-operative.

It would be quite feasible to extirpate, however, from such portions of the liver as are ordinarily exposed in abdominal operations, small or isolated tubercular foci, but the propriety of the procedure would be very doubtful, especially in the presence of multiple foci, since it might be safely assumed that there were others of equal menace on or in concealed portions of the viscus. Tuberculosis of the liver becomes then a surgical disease mainly in proportion as it may break down and produce pyoid collections, usually of the type of cold abscesses. So soon as these are suspected or discovered, they are amenable to the methods of treatment already mentioned when considering abscesses of the liver.

TUMORS OF THE LIVER

A variety of non-malignant as well as malignant tumors is described as occurring within the liver. Among the former a type of adenoma is met with which seems rather on the benign side of the borderland, and which, when favorably situated, may be extirpated; there being now several cases on record of successful removal of growths of this kind of considerable size. In general it may be said that any truly benign tumor of the liver which can be made accessible can be, with reasonable safety, removed, especially if encapsulated or reasonably outlined. With regard to truly malignant tumors, they must be discovered very early and must be very favorably situated in order to justify any surgical attack. Those which offer the best prospects in this direction are the carcinomas, which begin in the gall-bladder, and gradually extend to and involve, at first, the adjoining hepatic tissue. It has been my good fortune, in at least one such case, to remove a carcinomatous gall-bladder in which were two large calculi, one nearly the size of a hen's egg, where the disease had spread to the adjoining portion of the liver. Here some two inches of hepatic tissue were excised in each direction from the attachment of the gall-bladder, and the patient recovered and seven years afterward was free from any evidence of return. This case is very exceptional, however, but most interesting in that it shows what may be accomplished in this direction.

Under ordinary circumstances cancer does not long exist within the liver, no matter whether primary or secondary, without extension to the peritoneum and the viscera immediately in relation with it; hence the stomach and the pancreas or the colon are usually soon involved. This fact of itself makes operation of rare and doubtful utility. If, it should ever happen, however, either during exploratory abdominal section or the performance of more deliberate operation, that an isolated and reasonably small mass of cancerous tissue should be detected in an accessible portion of the liver, one need feel little hesitation in excising it, especially if he be expert in abdominal work. The removal may be effected with the actual cautery, in which case there will be less immediate hemorrhage; or with the knife and scissors, hemorrhage being controlled by catgut sutures passed through the entire thickness of the margins of the liver wound, at sufficient distance, tied not too tightly, and at intervals frequent enough to control hemorrhage. Only those who have done much work upon the liver realize fully how comparatively easily hemorrhage from this source is controlled. Ascites is an almost inevitable late complication, and may compel repeated tapping, just as when due to other hepatic disease. It is of extreme pathologic interest and import that cancerous infection often follows the track of the trocar or the knife; this fact furnishes a most cogent argument in favor of its parasitic nature.

CYSTS OF THE LIVER

The majority of hepatic cysts are of hydatid origin, and the majority of these, when not multiple or not seen too late, are amenable to surgical attack. The same is true of those of non-parasitic origin when they occur. The presence of a cyst is sometimes determined by the use of the exploratory aspirating needle; at other times it is revealed in the course of an exploratory abdominal section. When once recognized, the question arises whether to treat it by enucleation or by incision and drainage. This is a matter to be decided partly by its location and character, partly by the taste and experience of the operator, and partly by the environment. Enucleation may be attempted in cases where the entire cyst seems quite accessible and the measure itself not too dangerous. It is, however, a procedure exposing the patient ordinarily to greater hazard than the other way of dealing with it, by incision and drainage. The latter course having been determined, one should endeavor, if possible, to fix the most accessible portion of the cyst wall to the margin of the abdominal wound. This can often be done, especially if the cyst be of considerable size or near the anterior surface. If it really present posteriorly, the opening may be made in the loin. If adhesions have already formed which may serve as a protection, the abdominal wound may be completely closed and a fresh incision made at the indicated place. If one have to suture the cyst wall to the surface, especially if tension be considerable, it would perhaps be well to divide the operation into two stages, waiting for adhesions to form, and making the incision and the drainage two or three days later. In this way, by a process of marsupialization, as it has been termed, a large sized cavity may be practically externalized and permitted to connect only with the exterior.

It is desirable to protect the peritoneal cavity so far as possible from all contact with the contents of a hydatid cyst, whether suppurating or not, and every care and precaution should be taken to this effect. When the cyst itself is opened, there is no objection to making the incision into it as large as possible; in fact, it is rather an advantage, since it permits more ready attack upon the lining membrane or endocysts. Not only should the contents be evacuated, but thorough curettage should be performed, with perhaps cauterization of the walls of the cavity. Occasionally it may be possible so completely and widely to open it that sutures may be introduced through the incision and folds made or puckered up within the cyst cavity, by which it may be materially reduced in size. Nevertheless, save in cases of most rigid cyst walls, one may always rely on the fact that the cavity, being emptied, will be collapsed by pressure of the surrounding viscera.

THE SURGERY OF THE BILIARY PASSAGES

When a case of biliary obstruction, no matter how produced, has failed to improve under suitable medicinal and dietetic treatment, it becomes a legitimate surgical case, save in those evidently hopeless forms of cancer where nothing can under any circumstances be done.

In other words, the indications for surgery of the biliary tract are the failure after not too prolonged effort of other means to produce the desired benefit. This failure should be apparent within a short time, and cases should not be kept indefinitely upon drug treatment nor upon the waiting-list. Furthermore, cases of evident distention of the gall-bladder, no matter what may be the suspected cause, accompanied by pain, tenderness, or muscle spasm, either or all of them, are best promptly dealt with by surgical intervention. A few years ago I ventured to propose that the gall-bladder should be treated much as we treat the appendix, *i. e.*, that when it proves to be a source of trouble or of offence it should be attacked and usually removed. Plausible reason for so doing will be afforded by the fact that when obstructed it is a shut sac, and that shut sacs are always sources of offence when they contain material which has been or can be exposed to infection. A gall-bladder which cannot be with evident safety removed should always be opened and drained and the principal indication thus met.

The following somewhat formidable list of operations which have been suggested and practised at different times upon the component parts of the so-called biliary tract is not really so formidable as it appears, but will be found upon analysis to comprise only two or three different measures to which particular names have been attached as they affect one or another of its parts: cholecystotomy, cholecystostomy, cholecystectomy, cholangiotomy, cholangiostomy, choledochotomy, choledochostomy, hepaticotomy, hepaticostomy, cholecystenterostomy, choledocho-enterostomy, cholelithotrity, cholelithotomy, cholecystendesis.

Practically all these different titles refer to temporary opening of some portion of the biliary tract, either for the removal of foreign bodies or for drainage, or else to a more permanent opening by which biliary drainage may be maintained for so long a time as may be desired. The latter will prove of greatest relief in many cases of liver long dammed up by obstruction of the biliary outlets, or by a pancreas enlarged and affected in much the same way. A very marked reduction in the size of the liver, usually a disappearance of the so-called "Riedel's lobe" (see above), will be noted after surgical relief of biliary obstruction.

Operation, once decided upon, consists, first of all, in a sufficient opening, near the outer border of the rectus muscle and parallel to or else between its fibers, to permit easy exposure and exploration of the entire biliary tract. This will always be found easier in women who have borne children, since in them the abdominal wall is looser and more relaxed. It needs always the aid of profound anesthesia for the purpose of relaxation, while ease of exploration will be greatly enhanced by a firm sand-bag or cushion under the mid-dorsal region, by which the body is bent somewhat backward and the deeper parts thus brought nearer the anterior surface. In exceedingly obese individuals the opening has naturally to be made larger than in those who are quite thin.

According to the degree of cholemia and the relative reduction of the coagulating power of the blood it will be found of great advantage to prepare the patients for these operations by a preliminary course of calcium chlorid or lactate, giving doses of 2 to 4 grams, freely diluted, three or four times a day, for several days prior to operation, this constituting one of the most reliable expedients in the control of persistent hemorrhage. The abdomen having been opened, one may be confronted at once by adhesions, recent or old, which mask all other conditions, or he may find free access to the very end of the common duct. What he shall decide to do must depend, in large measure, upon the general character and underlying features of the case. If it be one of actual septic infection, a post typhoidal infectious cholecystitis, for instance, he may well content himself with the least amount of manipulation required for exposure of the gall-bladder, at its anterior end, that will permit of its being fastened around a rubber drain. Abdominal fixation may be unwise or impossible. If, on the other hand, the seriously infective element can be excluded, he may find recent, tender, peritoneal adhesions, as the result of a mild degree of perihepatitis and local peritonitis, produced during the intensity of recent attempts at expulsion of gall-stones. Here one need not hesitate to separate adhesions, tying off those which bleed, and gently but sufficiently exposing the depths of the cavity until one has gone so far as one sees fit. Under all circumstances it is wise to wall off and protect the general abdominal cavity as much as possible, even though it be generally accepted that the contents of the gall-bladder are not, under ordinary circumstances, especially infectious. Even when thoroughly believing this, one may still prefer to prevent contamination from any source.

A distended gall-bladder does not always contain calculi; their presence or absence is a matter of small importance; it may be largely distended from retention of its own contents, and this is an indication for drainage. When gentle pressure upon it permits its gradual emptying, it will, of course, be assumed that biliary obstruction is not complete. Here one calculus or several calculi may or may not be present. If they can be detected at any point, they should, of course, be removed. It is occasionally possible to push them on, but this is unwise; they should be positively removed; that is, they should be pressed back into the gall-bladder, and one should then make sure, after opening it, that they are all removed. Calculi which are so impacted in any of the ducts as to be practically immovable have been crushed between the fingers or the padded forceps; this especially by those who hesitate to open the duct and hope that the detritus thus produced will be or may be forced along the passage and finally evacuated. It is not, however, the general practice of the best surgeons to so treat them; it being found ordinarily far more satisfactory to make in the duct a sufficient incision to permit their being lifted out and removed *in toto*. If, now, the duct have been so dilated that sutures may be easily introduced without increasing the danger of subsequent stricture, it may be quite permissible, even advisable, to use them. Undesirable as it may seem in theory, it has been found the best practice simply to drain such a duct, by a tube, which may be even inserted into it and held for a sufficient length of time by easily absorbable catgut sutures, which shall disappear within two or three days and permit later withdrawal of the tube without injury. Any portion of the duct which may require such treatment will be found quite amenable to it. This may or may not be combined with drainage or removal of the gall-bladder itself.

In all circumstances where gall-stones are exposed and removed one should assure himself of the patulousness of the duct by passing a probe along it and practically through it. Unless some unforeseen circumstance make it impossible or inadvisable to pursue such an investigation, it must be made complete and the effort not discontinued until the duct is cleared. It is by no means easy in all cases to trace the duct from the gall-bladder down to its entrance into the duodenum, and then to identify the latter, and be sure that no stone is impacted within the intra-intestinal portion of the duct. Here the ampulla of Vater offers an easy resting-place for calculi which have come down from above, while if at this point a stone be found, one must either open the duct and push it on, provided it cannot be expelled with gentle finger pressure, or else must open the duodenum itself and thus remove it from within. In exceedingly stout individuals with numerous old adhesions this becomes, in some cases, a formidable and difficult procedure. After opening the duodenum one should, if possible, use sutures for completely closing the incision after its purpose has been achieved.

A gall-bladder partly or completely filled with calculi, which is not too adherent and not too much thickened by old disease processes, may well be completely removed. This may be done with or without drainage of the duct. A gall-bladder containing a few calculi, which is shriveled in size and has receded, so that it is even found with some difficulty and after considerable effort, is not so easily removed and may be better drained. Here the end of the tube must be fastened into its cavity by catgut sutures which may be expected to be absorbed within a few days. Occasionally a gall-bladder is so distended with retained contents, or even with calculi, as to hang down within the abdomen, even to such a degree as to be mistaken for a floating kidney. When this condition is revealed, cholecystectomy is almost invariably indicated. Nearly every gall-bladder left *in situ* should be curetted with a sharp spoon and the interior then cauterized with pure carbolic acid.

One danger attending the long-continued presence of calculi is the occurrence of cancer, apparently as an expression of rebellion and infection from continued irritation. This is one of the cogent arguments for removal of gall-stones before such an unfortunate condition has been produced. That a cancerous gall-bladder, and even cancerous adjoining liver tissue, may be removed with final success has been made plain to me, in my own practice, by removal of a very much enlarged, thickened, and cancerous gall-bladder, containing large calculi, with involvement of the adjoining liver tissue, where complete extirpation of the former and wide removal of the latter were followed by complete restoration to health, without return of disease after several years. Therefore, in cases which seem to justify it, especially by non-existence of cancerous foci elsewhere, one may practise even extensive operations of this kind justifiably and successfully.

As one becomes more expert in this kind of surgery, and of wider experience, one will not need to employ incisions so large as those through which he begins his work. Nevertheless when occasion demands it one need not hesitate to make them as extensive as may be called for. Moreover, if necessary, a portion or all of the rectus muscle may be divided transversely. These incisions are closed, in greater part or *in toto*, with buried chromic as well as superficial silk or other sutures, according as drainage may or may not be indicated. It is desirable to bring together each layer of abdominal aponeurosis by itself, and to make all as secure as possible, particularly in cases where drainage is employed, in order to obviate later tendency to ventral hernia. This will occur occasionally, in spite of every precaution.

If liver tissue itself have been attacked, it will probably have been found necessary to insert catgut sutures, preferably with a Hagedorn needle, in order to cut liver tissue as little as possible. One will be aided in this work, moreover, by injecting a weak solution of adrenalin around the bleeding margins. In these cases the surgeon will probably desire to leave some gauze packing, and may have to leave considerable of it. This, of course, requires a larger drainage opening. In such an event the employment of secondary sutures will be wise, *i. e.*, those which may be utilized later for better approximation of wound edges.

A gall-bladder which contains pus, and calls for drainage on this account, is best disturbed as little as possible. Here the margins should be carefully united to those of the peritoneum and deep aponeurosis, and every possible precaution taken to avoid escape of any drop of pus into the abdominal cavity. It might even be wise to wait, when one can, for a few hours before making the final opening into this cavity. It used to be the practice to sew the gall-bladder to the skin. This not only displaces it more, but leaves a fistulous track much more difficult to heal when the time comes for it to close. By the above expedient of uniting it to the deeper part of the abdominal wound much difficulty of this kind is avoided.

Chronic cases, where biliary drainage for a considerable length of time is desired, may ordinarily be drained from the gall-bladder, or much less frequently through one of the ducts. Biliary fistulas thus established sometimes outlast their actual usefulness, but usually close in time and rarely require secondary operation. When the gall-bladder itself is drained, it usually becomes in time obliterated by granulation and cicatricial contraction. That the gall-bladder itself is a luxury rather than a necessity is shown not only by such cases as these, but by the results of cholecystectomy, and by the fact that there are numerous animals which have no gall-bladder and that seem in no wise to suffer from its absence.

Cholecystenterostomy.—The operation of uniting the gall-bladder or even the duct with a loop of intestine has been now practically abandoned, and it is only under peculiar circumstances that it is ever thought to be necessary. Extirpation and permanent drainage have been found much more serviceable and useful measures.

This has hardly seemed to be the place in which to discuss the details of surgical technic, but rather to give indications and to consider general principles. In a general way the surgery of the biliary passages has made tremendous advances within the past twenty-five years, and is now considered as safe and as desirable as that of the appendix; in fact, there are many points of relationship between the two, and common principles govern nearly all instances of lesion in either locality, either the acute infections or the chronic obstructions. Moreover, experience shows that relief comes more quickly, more completely, and, in every way, satisfactorily, by the surgical route in all instances where it is at all indicated, and that physicians and patients alike are guilty of serious errors of judgment when they delay and are willing to call in the surgeon only as a last resort when death is impending or when vitality has been reduced by long suffering.

THE SURGICAL TREATMENT OF ASCITES

Within the past fifteen years it has been suggested and attempted to afford additional venous communication between the veins of the portal system and those of the general circulation by producing adhesions between the viscera, especially the omentum, and the surrounding abdominal walls, for the purpose of relieving the overloading of the portal vein caused by hepatic cirrhosis. The suggestion is generally credited to Telma, but the measure was first warmly advocated by Morison, who first operated in 1895. The theory of the operation is simple and the method by no means difficult. If considered dangerous, it is because here, as in too many other instances, physicians have waited too long and disease processes have advanced too far before resorting to the operation. In theory, then, it has much to commend it and little to repel, if only it be performed in time. Its principal feature is fixation of the omentum to the parietal peritoneum, hence it is often spoken of as **omentopexy.** Mere suture fixation is not enough, since the intent is to secure broad adhesions, through which venous anastomosis may be produced. If a number of fresh communications are to be established, large surfaces must be denuded and brought into mutual contact. Therefore the upper and outer surfaces of the liver and the spleen, which lie in contact with peritoneum, should be utilized, as well as the anterior surface of the great omentum.

In its performance the abdomen is opened sufficiently widely and emptied of all the fluid which it at that time contains. Then rough friction is made on the peritoneal exposures of the liver and spleen, as well as over the adjoining parietal peritoneum, the deliberate attempt being to roughen them until they begin to ooze. After this the omentum is delivered from the wound and its external surface treated in the same way, while again the peritoneum to which it is to be affixed is roughly handled as before. Then, so far as the opening and the dexterity of the operator permit, a series of catgut sutures are inserted in such a way that the omentum is quite firmly tacked up to the anterior abdominal wall, after which the abdomen is closed as after any other operation.

Schiassi has extended this procedure into an **omento-splenopexy.** After raising the abdominal wall at the height of the umbilicus by a low transverse abdominal incision across the median line, combined with another in the left semilunar line, the peritoneum is opened transversely, the omentum drawn and spread out between the peritoneum and transversalis fascia, and is there sutured in its new position; *i. e.*, it is *externalized* so far as the peritoneum is concerned. Through a vertical opening in the peritoneum the spleen is then exposed and lifted out, while with a long curved needle three to six chromic sutures are made to fasten it to the peritoneum and muscles of the abdominal wall, only the skin being excluded from their effects. The external wounds are closed as usual.

It must be acknowledged that the mortality of the collected cases is discouragingly high. This is due to the fact that they have been so long delayed, physician and patient rarely consenting to the surgical procedure until the condition of the latter is desperate and tapping has been many times repeated. The operation, in and of itself, is attended by little danger. If it were performed at a much earlier relative date, it would rarely be followed by death, and would give very much more satisfactory results. There can be no question about this fact, and it is, therefore, unfair to quote statistics already gathered which present the measure in its worst light, rather than in its best. In exceptionally favorable cases it has been noted that the abdominal veins show most marked enlargement in course of time, all of which is to be interpreted as indicating the great measure of success attained.

DISEASES OF THE PANCREAS

By James M. Anders, M.D., LL.D.

PANCREATIC HEMORRHAGE

Under this caption I shall consider only those rather unusual and interesting cases of sudden apoplectiform death in which the autopsy does not reveal any other change in the body to explain the occurrence of the catastrophe, and in which an extensive hemorrhage is found to infiltrate the substance of the pancreas and possibly the adjacent structures.

The morbid process that precedes such hemorrhage is that of fatty degeneration and atheroma of the arteries of the pancreas, and this condition may be enhanced by the existence of either acute or chronic inflammation. Old age, male sex, sclerosis of the vessels, as induced by chronic nephritis, syphilis, alcoholism, and glycosuria, may serve as potent predisposing factors. Traumatism, either from without or from pancreatic or hepatic calculi, may excite hemorrhage. The writer has collected 40 cases of pancreatic hemorrhage.* It occurred in patients over forty-five years of age in 43.3 per cent., and the ratio of males to females was as 3 to 1. There was a history of chronic alcoholism in 18 out of 30 cases, or about 66.6 per cent.

The usual course of pancreatic hemorrhage is rapid, the process terminating fatally in from one-half to a few hours in the severer forms of those where death results from shock, and in from a few days to a fortnight in less severe forms. In certain cases the initial attack is rather mild, and softening and putrefaction of the pancreas follow, in which instances the patient develops peritonitis, with fatal termination.

The onset is sudden and violent, and is evidenced by excruciating pain in the epigastrium or between the xiphoid and umbilicus, nausea, and vomiting. These symptoms are followed by those of collapse—anxious expression, cold, clammy sweat, rapid, thready pulse, subnormal temperature, cyanosis, and localized tenderness and rigidity above and to the right of the umbilicus.

Treatment.—*Treatment Based upon Our Conception of the Morbid Process.*—In cases of idiopathic hemorrhage of the pancreas treatment should be directed to the commonest pathologic change in this organ—arterial sclerosis or atheroma of the vessels. It is to be considered, further, that this degeneration of the blood-vessels is, as a rule, widely distributed throughout the arterial system.

The patient should be put at absolute rest. In mild hemorrhage the administration of nitroglycerin in doses of $\frac{1}{100}$ grain and of adrenalin chlorid (♏ij to x of 1 : 1000 solution), every two to four hours, may prove of service. Whenever the hemorrhage is induced through traumatism, either as the result of calculi or through extraneous injury, it may be advisable to administer the fluidextract of ergot in small doses every hour or two, or to give the extract of ergot in doses of ½ grain every two hours. This treatment should be continued until it is possible to obtain the advice of a surgeon, since the traumatic form should be regarded as being a surgical condition.

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* Jour. Amer. Med. Assoc., Dec. 2, 1899, p. 1393.

Treatment Based upon Certain Predominant Symptoms.—The treatment of the shock is palliative and symptomatic. The subnormal temperature calls for the external application of heat, which may be accomplished by filling either rubber or glass bottles with warm water, wrapping each bottle in a linen towel, and placing them along the sides of the body, limbs, and at the head and feet. Blankets, when heated in an oven or upon a radiator, and wrapped about the patient, are of inestimable service. The temperature of the room should be from 75° to 85° F., and the patient should be kept out of all drafts.

The injection of one or two quarts of sterile normal saline solution (temperature 100° to 110°) beneath the breasts and into the subcutaneous cellular tissue of this region is a measure which usually acts promptly in restoring arterial tension. In case the physician has not the necessary means at hand for sterilizing the saline solution, he will achieve much by administering the hot saline solution by rectum into the bowel. A far more prompt reaction upon the heart is to be obtained by injecting sterile salt solution directly into the vein of the arm (a measure more especially serviceable after profuse loss of blood), but since this procedure requires the skill of the surgeon, he should be called to conduct its administration.

Medicinal Treatment.—Administer by mouth such hot drinks as strong coffee. Aromatic spirits of ammonia (1 fluidram in one-third glass of hot water) and whisky (½ fluidounce in one-half glass of hot water) may be administered every half-hour to every hour as indicated by the pulse and general condition of the patient. Adrenalin chlorid is also invaluable. Strychnin sulphate or strychnin nitrate may be given in doses of from $\frac{1}{40}$ to $\frac{1}{20}$ grain to meet the requirements of special cases. Care should be exercised lest the drug be stored up in the gastro-intestinal tract, and the entire amount given be absorbed into the system later, and at a time when it is not needed. To avoid this danger all preparations of strychnin should be administered in solution.

Hypodermic Medication.—This is the truly ideal method for the administration of medicine when given with a view to combating shock. Strychnin sulphate or nitrate may be given in doses of from $\frac{1}{100}$ to $\frac{1}{20}$ gr. every hour or two to meet the indication. Atropin sulphate, in doses of from $\frac{1}{200}$ to $\frac{1}{50}$ gr., is among the drugs of choice, as is also digitalin, in doses of from $\frac{1}{100}$ to $\frac{1}{50}$ gr. Morphin sulphate, gr. $\frac{1}{24}$ to $\frac{1}{12}$, is warmly recommended. Adrenalin chlorid in doses of

6 to 10 minims will be found to exert a powerful and prompt activity upon the vasomotor system, and to restore the normal blood-pressure. Diffusible stimulants, as aromatic spirits of ammonia and whisky or brandy, will be found of value. The following favorite formula will prove of inestimable service in relieving the general symptoms of shock:

℞.	Adrenalin chlorid (1 : 1000)	♏v
	Morphin hydrochlorid	gr. $\frac{1}{24}$
	Nitroglycerin	gr. $\frac{1}{60}$
	Atropin sulphate	gr. $\frac{1}{80}$

Whenever hypodermic medication is employed it is necessary for the physician to be ever alert for the effect of any one or all drugs thus administered, and to discontinue this method at the earliest moment.

ACUTE PANCREATITIS

Acute pancreatitis may result from a variety of chronic conditions, and during the course of infectious maladies, in which instances hemorrhagic pancreatitis is probably of a bacterial nature. Hemorrhagic pancreatitis is also artificially induced by the introduction of either bacteria or acids into the substance of the pancreas or into the pancreatic ducts.

Among the predisposing factors are to be mentioned gastroduodenal catarrh, traumatism, alcoholism, pancreatic hemorrhage, glycosuria, syphilis, and gout. This condition is extremely rare in persons under fifty years of age.

The pancreas is enlarged, at times rather firm, and there are to be seen irregular circumscribed areas of hemorrhagic infiltration. These are disseminated throughout the interstitial tissue and present a chocolate-colored appearance. There may be seen a round-cell infiltration, and at times there is evidence of degeneration of the pancreatic tissue. The peritoneum enveloping the pancreas may display slight hemorrhages. Areas of fat necrosis are met with in the pancreatic tissue, in the omentum, mesentery, and abdominal fat; and glycerin is excreted with the urine, as is shown by Cammidge's reaction.

The onset of hemorrhagic pancreatitis is usually sudden, the attack terminating fatally in from a few hours to as many days. It is ushered in with violent, deep-seated pain in the epigastrium, or between the xiphoid and umbilicus, which pain is soon followed by the general symptoms of more or less profound shock, depending upon the degree of hemorrhage. Hiccough, tympanites, albuminuria, constipation, and evidence of intestinal obstruction without definite cause are among the commoner symptoms. The pain, collapse, and general cyanosis may be due to pressure of the hemorrhage upon the solar plexus. The temperature is but slightly elevated, if at all, at the onset, although it may touch 103° or 104° F. later during the course of the illness. Death results from shock.

Treatment.—*Treatment Based upon Our Conception of the Morbid Processes.*—In view of an acute hemorrhage into the substance of the pancreas, it is well to place the patient at absolute rest, and in the recumbent posture, since any exercise or movement would accelerate the heart, and thereby enhance further hemorrhage. Independent of how slight the hemorrhages into the pancreatic tissue may be, shock, which is invariably present to a greater or lesser degree, requires prompt and heroic treatment, as outlined under pancreatic hemorrhage.

At the end of twenty-four hours the patient has usually rallied from the shock and requires further treatment, as indicated by the morbid processes existing either in the pancreas or in the adjacent viscera (liver, hepatic ducts, duodenum, pancreatic ducts). Should acute hemorrhagic pancreatitis depend upon a toxic process in the course of some infectious malady, our first aim should be to eliminate from the system the toxins from which the patient is suffering. This elimination is best facilitated by stimulating to action the kidneys, the skin, and the intestinal tract. It is important to insist that the patient drink freely of water and of mild alkaline drinks, thereby thoroughly flushing the renal system. Hot baths and sponging of the skin, using gentle friction, with one part alcohol in three parts of water (hot as the hand can bear), will be found materially to increase the activity of this vital organ of excretion. Citrate of magnesia or phosphate of soda (1 dram) should be administered in a glass of cold water every three hours until the intestinal tract is thoroughly emptied.

Treatment Based upon Certain Predominant Symptoms.—Symptomatic treatment includes the management of shock (in pancreatic hemorrhage). The after-treatment has to do particularly with maintaining the patient's strength, and encouraging to functionate the secretory and excretory organs. The strength of the patient is best preserved by such stimulants as strychnin sulphate (gr. $\frac{1}{40}$ every two and one-half hours) and by moderate doses of alcohol. Atropin has been recommended by certain writers, but when given, it should be borne in mind that this drug inhibits the action of the skin, and thereby interferes with excretion. The pulse, when rapid, weak, or irregular, should be supported by the use of tincture of digitalis, strophanthus in doses of from 2 to 5 minims every four hours, and by the administration of nitroglycerin in doses of $\frac{1}{100}$ gr. every two to four hours. Adrenalin chlorid, ♏iv to x of 1 : 1000 solution, will be found most effectual in restoring the blood-pressure. The taking of warm drinks, as, for example, hot milk, will be found of service. Hypodermic medication is seldom indicated after reaction from the shock, although whenever such treatment appears necessary, it should be resorted to in the manner described under pancreatic hemorrhage. The treatment of pain is often of special moment, and requires morphin for its relief, which should be given in doses of from $\frac{1}{24}$ to $\frac{1}{4}$ gr. by mouth, and from $\frac{1}{24}$ to $\frac{1}{8}$ gr. hypodermically. Morphin is of further value since it provides absolute rest for the patient, thereby preventing the unnecessary expenditure of energy—a most necessary action.

The extreme prostration and weakness are, as a rule, progressive, and call for vigorous alimentation with predigested foods. It is well to have the food that is given by mouth partially predigested at least before its administration. Again, the administration of nutrient enemas from once to thrice daily will be found serviceable in maintaining the general strength and vitality. For this I prefer the following: Milk, fl.oz. 4; the white of one egg; whisky, ½ oz. Mix together with one Chamberlain's peptonizing tube, place in an agate receptacle, and heat to a temperature of 100° F. for from fifteen to twenty minutes, then place in a small rubber syringe, and inject slowly into the rectum.

Treatment Based upon the Examination of the Organs of the Body.—The stomach is usually the seat of either subacute or chronic catarrh, which demands special attention. Such agents as tincture of nux vomica, ♏v, one-half hour before meals; dilute hydrochloric acid, ♏ iij to x, one-half hour after food; and pepsin, pancreatin, and gentian are also of value.

The intestinal catarrh may involve either the large or the small bowel. Intestinal derangement is often placarded by constipation, tympanites, and fatty stools. Extract of fel bovis (ox-gall), in doses of from ½ to 2 gr. every two and one-half hours, acts admirably as a laxative and as an intestinal antiseptic, preventing the formation of gas. Ox-gall may also exert a favorable action upon the fats ingested, although this is somewhat questionable in the opinion of certain writers. Sulphate of magnesia, phosphate of soda, divided doses of mercury, and extract of taraxacum, in doses of from ¼ to 1 gr. every four hours, will be found to relieve the constipation.

The tympanites is often relieved by frequent doses of salolis (gr. ij to viij every two to four hours). The same end may be achieved with beta-naphthol and salicylate of bismuth in doses of from 3 to 10 grains three or four times daily. A capsule composed as follows will be found of special service:

℞.	Hydrargyri chloridi mitis	gr. j
	Extracti fellis bovis	gr. xviij
	Creosoti	♏ vj
	Phenylis salicylatis	gr. xxxvj
	Beta-naphtholis	gr. xxiv

Ft. et capsulæ No. xii.
Sig.—One every two hours.

Treatment Based upon the History of the Patient.—The vast majority of these cases occur in persons who have lived too well, and who are beyond the age of fifty years, and as a consequence our treatment must be directed toward general arterial sclerosis. This condition may also be inherited, in some instances at least. Again, one may be dealing with a general lithemic condition, which is often made doubly evident through the fact that the urine contains a large amount of oxalate of calcium and of uric acid. Alkalithia in doses of a teaspoonful twice daily, given in a glass of water three hours after meals, often reduces the highly acid condition of the urine, and its administration is also likely to be followed by a diminution in the amount of oxalic acid excreted. Dilute hydrochloric acid, in doses of from 3 to 10 minims, given in water one-half hour after meals, is of special service in this connection. Indeed, we are not uncommonly dealing with diabetes, in which instance the diet generally accepted in this connection is to be carried out. On the contrary, pancreatic disease may excite glycosuria, in which case pancreatic or hepatic calculi may compress the pancreas, and should receive the attention of the surgeon.

Hemorrhagic pancreatitis may be also encountered in persons suffering from valvular disease of the heart. One is ever to bear in mind the influence that such a condition may exercise upon the vascular system in general. The close relationship existing between hemorrhagic pancreatitis and chronic valvulitis is one worthy of careful consideration, especially when administering cardiovascular stimulants with a view to combating shock, since, according to the experiments of Crile,* digitalis does not raise blood-pressure during shock. A history of hepatic colic renders the condition one for surgical intervention.

GANGRENOUS PANCREATITIS

This is a condition wherein the pancreas is found to present various stages of softening, friability, and degeneration, which changes usually surround small areas of hemorrhagic infiltration of this organ. These areas, or in fact nearly the entire pancreas, may be seen to be a brownish-black or greenish, softened, gangrenous mass, which, at times, becomes liquid or semi-liquid, and is contained within the omental cavity. The gangrenous tissue may emit a foul odor. This condition is often superseded by perforating gastric ulcer. Inflammatory conditions of the biliary ducts, catarrhal conditions of the duodenum and of the pancreatic duct, and traumatism serve as potent etiologic factors, and it is more likely to occur after the age of forty.

The initial features of gangrenous pancreatitis are practically those of hemorrhagic pancreatitis, to which have been added the symptoms induced by the absorption of ptomains from the gangrenous tissue (sapremia). The course is usually rapid, lasting over a period of from one to four or more weeks, at which time it tends to terminate fatally. Instances are recorded, however, in which the gangrenous material has escaped through the rectum, and the patient recovered.

Treatment.—*Treatment Based upon Our Conception of the Morbid Process.*—The intestinal tract should be flushed thoroughly by the use of salines, and then sufficient of a mild laxative should be given to produce one evacuation of the bowel daily. Absolute rest in bed and the administration of predigested foods are indicated. Owing to the loss of function of the pancreas, all foods containing fats are interdicted; and since proteid digestion is, as a rule, tardy in such conditions, foods containing albumins should be given but sparingly. Gangrenous pancreatitis demands the intervention of the surgeon, and in practically all instances his counsel should be obtained without delay.

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* "Blood Pressure in Surgery," 1903, pp. 48–50.

Treatment Based upon Certain Predominant Symptoms.—The pulse is rapid, weak, irregular, and compressible, and demands cardiovascular stimulants; among which whisky, $\frac{1}{2}$ fluidounce every two to four hours; strychnin sulphate, $\frac{1}{40}$ grain every two hours; and infusion of digitalis, 1 fluidram every four hours, will be found of value. The parched condition of the mouth and the heavily furred tongue call for a special toilet of the buccal cavity; such as brushing of the teeth, tongue, and mucous surface of the oral cavity with mild antiseptic solutions, as boracic acid, glycothymolin, and the like. The excessive parching of the lips and tongue is relieved by the sucking of small pieces of ice, or by moistening these mucous surfaces with a solution composed of one teaspoonful of glycerin in one-half glass of ice-water.

Treatment Based upon Examination of All the Organs of the Body.—The most important features in this connection are the presence of glycerin in the urine and of fats and proteids (meat fiber) in the feces. Unless both the fats and the proteids be partly predigested, treatment appears to exercise but little influence upon the digestion of these food substances. Constipation, when present, should be relieved by the administration of mild laxatives (*vide supra*). Tympanites may at times be accompanied by diarrhea, and calls for such intestinal antiseptics and astringents as beta-naphthol, salol, bismuth subnitrate, and bismuth salicylate. Diabetes developing during the course of pancreatic gangrene demands that all starches and sugars be avoided; yet but little is to be accomplished through these measures because of the irremovability of the causative affection.

Treatment Based upon the History of the Patient.—This is of but little consequence except that we have to deal in most instances with persons of advanced years, who have previously suffered from hemorrhagic pancreatitis, and their treatment in this respect would be practically that outlined under the latter condition.

SUPPURATIVE PANCREATITIS

This is a condition wherein the substance of the pancreas becomes the seat of suppuration. A single abscess may occupy the head of the pancreas, or multiple abscesses may be diffused through the organ. Peripancreatic suppuration is not uncommon, and pyemia may be seen to follow pancreatic abscess. Fat necrosis and pancreatic hemorrhage are also induced by such abscesses.

Among the leading etiologic factors may be mentioned alcoholism, gluttony, and traumatism. Infection is probably introduced through the pancreatic ducts or from contiguity of suppurating foci. The disease comes on rather rapidly, is accompanied by severe epigastric pains, prostration, and collapse, and tends to eventuate fatally as a result of shock.

Treatment.—*Treatment Based upon Our Conception of Morbid Processes.*—In view of the etiologic factors, the treatment becomes that of catarrh of the duodenum or of the hepatic ducts or of the gall-bladder. The duodenal catarrh will be modified by broken doses of calomel, $\frac{1}{10}$ grain every hour for ten doses, followed by a saline to deplete the congested parts (citrate of magnesia, 1 dram, or magnesium sulphate, 11 drams, in a glass of water). Whenever there exists any tangible evidence of abscess of the pancreas, demands for the surgeon are imminent, and this is also true of cases in which there is evidence that suppuration has probably extended from neighboring suppurating foci.

Treatment Based upon Certain Predominant Symptoms.—Pain, when present, calls for the administration of opiates for its relief—morphin sulphate, $\frac{1}{24}$ to $\frac{1}{6}$ grain by mouth or hypodermically. Sweating is a fairly common symptom, and requires careful attention to sponging of the skin with one part alcohol in three parts of hot water. Picrotoxin in doses of from $\frac{1}{100}$ to $\frac{1}{75}$ grain three times daily will be found to control, in a measure at least, the excessive cutaneous glandular action. Belladonna, while it lessens the sweating, increases the urinary secretion, and is of questionable value.

Delirium may develop, and is oftenest of the low muttering type; it calls for such sedatives as trional, 10 grains in a glass of hot milk at night; hyoscin hydrobromate, $\frac{1}{200}$ to $\frac{1}{100}$ grain; both of these drugs, however, call for careful fortification of the heart by strychnin and digitalis before their administration. The application of an ice-cap to the head may alleviate the nervous symptoms. It is the rule for the delirious to be influenced by the action of cardiovascular stimulants, among which strychnin, whisky, nitroglycerin, and digitalis are to be favored. Hypodermic administration of these drugs is often necessary to tide the patient over a period of depression, and to fit him the best one can for surgical treatment. In cases in which the diagnosis of abscess of the pancreas is made early, the employment of antistreptococcic serum should be considered, although I am not aware of its having been used with success in this disease.

A liquid diet, composed for the most part of milk and predigested fats and albumins, will be found most serviceable.

Treatment Based upon History of the Patient.—Abscess of the pancreas demands prompt surgical treatment in every instance, except in cases in which such treatment is interdicted as the result of syphilis, cardiac lesions, diabetes, and nephritis.

CHRONIC PANCREATITIS

This is a chronic inflammatory process of the substance of the pancreas. It is of far more common occurrence than has hitherto been believed. Chronic pancreatitis is generally secondary to, and develops as the result of, chronic catarrh of the duct of Wirsung, which in turn is the result of gastro-duodenal catarrh, cholelithiasis, pancreatic lithiasis, and gastric ulcer; it is oftenest the result of direct extension of inflammation by contiguity of tissue.

According to Opie, there are two forms of this affection: One in which there is an increase in the connective tissue between the lobules;

and a second form where the change is that of an interacinar pancreatitis. In the former variety the islands of Langerhans escape involvement during the early stage of the disease, hence glycosuria is rarely present until late; while in the latter variety the islands suffer pathologic changes early, and glycosuria is common. Finney* has given an exhaustive and admirable discourse upon the occurrence of glycosuria in chronic pancreatitis.

The onset of the disease is insidious, as a rule, but may be subacute, and will be found to follow as a sequel of one or more of the above-named maladies. Its course extends over a period of months or years, during which time a variety of symptoms may develop. In a certain class of cases the clinical features are mild; in such there is but little pain, progressive loss of flesh, and a mass may be palpable in the epigastrium; epigastric distress after certain foods, paroxysmal attacks of vomiting, and occasionally jaundice may supervene. Fever is only present in cases in which the type of infection is severe. During the course of the more severe forms of chronic pancreatitis the symptoms resemble in a variable degree those of acute pancreatitis. There are severe epigastric pain and tenderness in the mid-epigastrium. Chills and fever may be present. Decided emaciation and a tendency toward hemorrhages are unfavorable features. Chronic pancreatitis tends toward a fatal issue, terminating in from a few months to as many years. Death results from exhaustion or from other causes.

Treatment.—*Treatment Based upon Our Conception of the Morbid Process.*—The treatment of the mild form of chronic pancreatitis, which is secondary to inflammation of the pancreatic or biliary ducts, is medical for a time. Milk and eggs provide the animal diet most appropriate for chronic pancreatitis. Yet vegetables in general are not interdicted. Fats are not to be taken except when previously emulsified. In certain cases we have to deal with cholangitis, and where this process is rather acute, the patient should be placed at rest in bed and hot compresses applied to the region of the liver, renewing them as rapidly as they become cold. Hot compresses may be kept wet with a solution of dilute nitromuriatic acid (4 fluidrams to the pint), or turpentine stupes may be employed instead, both being used with a view to producing some counterirritation. The bowels should be kept active by one of the saline purgatives, of which sodium phosphate is preferred, and should be given in dram doses as required to produce two or more liquid stools daily. Hunyadi water and similar mild laxatives will be found advantageous. A stay at a suitable spa (Bedford, Saratoga, Carlsbad, Kissingen) often proves serviceable. For the purpose of supplementing the natural juices of the intestines, which are commonly deficient, the following formula may be employed:

℞.	Pancreatini	ʒj (4.0)
	Sodii bicarbonatis	ʒij (8.0)

M. et ft. chart. No. xij.
Sig.—One an hour after meals.

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* Medical Chronicle, June, 1903.

In many cases one has to deal with gastro-duodenal catarrh, in which instances calomel may be given in $\frac{1}{10}$-grain doses every hour for ten successive doses, when it should be followed by a saline laxative, as magnesium sulphate or some one of the alkaline waters, with a view to relieving the congestion of the portal circulation and removing decomposable intestinal contents; this should be repeated at suitable intervals of time. The dietetic regulations must be influenced by the catarrhal condition of the stomach and duodenum, and in severe forms predigested proteids in liquid form only should be allowed. On the other hand, in the milder varieties usually met with, skimmed milk, whole milk with seltzer, broths, and even semi-solid articles of diet, or eggs, oysters, and the like, may be well borne. The writer has recently obtained excellent results from combined gastric lavage and high intestinal irrigation with a weak solution of some antiseptic agent, as boric acid or salicylic acid, in cases in which fermentative processes are conspicuous features. Intestinal antiseptics, as salol and betanaphthol, may also be given by the mouth for distressing flatulence. Malt diastase, combined with alkalies, should also be tried. Abelmann recommends minced pancreas for promoting the digestion of fats. When chronic pancreatitis is found to complicate gastric ulcer, it is probable that infection has extended from the floor of the ulcer to the pancreatic tissue. Here the treatment of gastric ulcer, while indicated, will be found to exercise little, if any, influence upon the condition existing in the pancreas. In general, medication, when applied with relation to the pathologic changes known to precede and to exist with chronic pancreatitis, is of limited value. In nearly every case surgical intervention is indicated when an assured diagnosis of pancreatitis is established.

Treatment Based upon Certain Predominant Symptoms.—Pain, when present, calls for the use of opium or its derivatives, which, unless the pain be severe, may be administered in the form of Dover's powder. Nausea and vomiting may, at times, be most troublesome, and to control these broken doses of calomel, cerium oxalate, bismuth subnitrate, carbolic acid, and cocain hydrochlorate (in doses of $\frac{1}{4}$ grain) before food may be found of value.

Progressive emaciation should be combated by forced feeding, which is accomplished through the administration of predigested foods by the mouth, and rarely by rectal alimentation. Should there be associated glycosuria, it then becomes necessary to administer such foods only as are known to contain a minimum amount of sugars. The general hebetude will be relieved by the giving of large quantities of Vichy water or of Poland water, through their effect upon the activity of the kidneys. The diuretic action of these waters may be increased by adding to each glass 3 to 5 grains of bicarbonate of potash.

CYSTS OF THE PANCREAS

Pancreatic cysts may be either single or multiple, varying greatly in size, and at times occupying the entire pancreas. Fifty per cent. of such cysts are found in persons between the ages of thirty and fifty; and 17 per cent. are seen to follow traumatism to the abdomen (Körte).* This condition develops slowly, and in fact may be congenital. The symptoms which arise as a result of its existence are colicky pains in the epigastrium, the left hypochondrium, or even the left shoulder, although pain is by no means a constant feature of pancreatic cysts. Among the other symptoms should be mentioned persistent jaundice and ascites, both of which result from pressure. Vomiting, and constipation, which at times alternates with fatty diarrhea, are less commonly seen. The stools may be clay-colored, pasty, and contain undigested proteids (much fiber) and fats, and they usually emit an offensive odor.

Intestinal hemorrhage may be observed at various stages of the disease, after which the stools are tar-like in appearance. Albuminuria and glycosuria are among the less common features of pancreatic cyst. Pancreatic cyst may present nothing locally of diagnostic value except a smooth elastic mass in the epigastrium; and emaciation, while fairly characteristic, is by no means a constant feature. Cysts of the pancreas seldom terminate fatally, since there is always time for surgical interference, which proves the only curative measure.

Treatment.—*Treatment Based upon Certain Predominant Symptoms.*—Pain, when present, calls for such sedatives as phenacetin, acetanilid, codein sulphate, and the various preparations of morphin. Locally, the application of heat to the epigastrium, turpentine stupes, and mild counter-irritation may bring about palliative relief.

Indigestion is present whenever pancreatic cyst is found to excite sufficient pressure upon the pancreas to interfere with its functions. Certain gastro-intestinal symptoms arising from such cause may be materially ameliorated by avoiding such foods as are known to contain substances which are acted upon by the pancreatic secretion. Thus, fats and lean meats should be predigested, or their introduction into the stomach should be followed by pancreatin, as should also the ingestion of all fatty foods. The pancreatic secretion is increased by dilute hydrochloric acid—5 to 10 minims in one-half glass of water, one-half hour after meals.

The progressive anemia and emaciation demand such hematinics as the pyrophosphate of iron, given in doses of 3 to 5 grains after meals; Fowler's solution of arsenic, 3 to 5 minims, well diluted, after food, three times daily; and glycerin extract of bone-marrow in doses of from one teaspoonful to a tablespoonful in one-half glass of ice-water after meals. While preparing the patient for surgical treatment it may be well to give small doses of strychnin sulphate, $\frac{1}{100}$ to $\frac{1}{30}$ grain, three to four times daily.

An examination of the feces will be found of special clinical significance whenever the function of the pancreas is deranged. The presence of fat in the feces and of particles of undigested muscle-fiber calls for the elimination of fats from the diet, or for the predigestion of these two classes of foods, and further explains the necessity of a skimmed-milk diet whenever the pancreas fails to functionate.

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* Arch. f. klin. Chir., 1904, xlviii.

Treatment Based upon the History of the Patient.—The previous medical history influences, in a measure, the treatment of pancreatic cyst. Thus, in cases in which there has been organic disease of either the heart or the kidneys special means and remedies are indicated, but these conditions, when present, are found to interfere more particularly with surgical intervention.

PANCREATIC CALCULI

The recognition of the presence of concretions in the pancreas dates to a paper by Giodiceandrea which appeared near the middle of the seventeenth century. Calculi may rest either in the substance of the organ or in the pancreatic ducts. The etiologic factors concerned in the production of pancreatic calculi are obscure, and the pathologic findings are probably induced by the presence of the concretions. Calculi situated within the substance of the pancreas may exist without causing appreciable symptoms; but should they move about there may be colic, epigastric distress, tenderness, and oppression. The attacks of colic are localized near the border of the left ribs and the pain circles along the left costal cartilages, becoming intense beneath the left shoulder. These pains may abate for a time and reappear with renewed violence, as was noted in Minnich's case.*

Treatment.—*Treatment Based upon Certain Predominant Symptoms.*—Pain when present calls for morphin or one of its preparations, which should be given to meet the requirements.

For the interference with pancreatic secretion, 1 to 2 drams of a 1 per cent. solution of pilocarpin may be injected subcutaneously three times a week. The taking of large quantities of food is by far the most reliable means of exciting free pancreatic secretion. Medicinal doses of dilute hydrochloric acid and acid drinks will be found to enhance free secretion of pancreatic juice. As a rule, the medical treatment is purely symptomatic and is preparatory for proper surgical intervention.

TUMORS OF THE PANCREAS

Cancer.—The medical treatment of pancreatic cancer is purely symptomatic. Our chief objects are to allay pain by the use of narcotics and to provide nourishment by both the mouth and the rectum by means of nutrient enemas.

Treatment Based upon Certain Predominant Symptoms.—Pain is a constant symptom and is relieved only by the use of opium or some of its preparations, among which morphin administered hypodermically is most valuable. It is always well to aid digestion, a favorite formula of Boas being:

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* Nothnagel's "Encyclopedia of Practical Medicine," p. 229.

℞. Pancreatin
Nitr. carbon.................................āā 0.5
M. f. pulv. comprim.
Sig.—Two to four tablets fifteen minutes after meals.

Jaundice is an almost constant feature, and the administration of cholagogs may increase the pressure from behind and thereby provide temporary improvement. In this connection sodium salicylate, in doses of 0.5 to 1 gm. three times daily, may be of value, but it cannot be continued on account of lessening the appetite. The salts of the bile-acids, fel tauri depuratum siccum, are recommended. Mineral waters rich in carbonic acid are of special service in relieving the system through their diuretic action. The administration of fluids by the rectum may be employed in cases in which there is an absence of diarrhea.

Itching of the skin will be relieved by the use as a daily bath of a few gallons of hot water to which one-fourth of a pound of soda has been added. Soda is equally valuable when employed in the form of a bran bath. Washing of the skin with dilute vinegar, 1 fluidounce to a liter of hot water, is often employed. A 1 to 2 per cent. solution of carbonic acid is also of service (except where there are abrasions of the skin). Rubbing of the skin with fresh lemon-juice and spraying the skin with methyl-alcohol are to be recommended in severe cases. Relief will often follow the use of hot baths.

Diarrhea, when present, is controlled by bismuth salicylate, 10 to 30 grains two to four times daily; beta-naphthol, 5 grains every three hours; and salol, 5 to 10 grains every three hours. *Constipation* may be present, and calls for mild laxatives.

Other tumors of the pancreas are sarcoma, which is seldom primary, and adenoma, both of which demand symptomatic treatment.

THE SPECIAL CIRCUMSTANCES IN OPERATIONS UPON THE PANCREAS

By B. G. A. Moynihan, F.R.C.S.

There are two circumstances of the highest importance in connection with operations upon the pancreas.

The first refers to **hemorrhage.** The pancreas has a blood-supply in proportion to its requirements as the gland by which the most important of the digestive juices is secreted. It is extremely vascular; its blood-vessels are both large and numerous. Any injury of the gland, therefore, causes free bleeding; bleeding which is, moreover, very difficult to control. When, as the result of direct incision, bruising by external force, or tearing during the removal of growths involving the stomach or the pancreas itself, hemorrhage occurs, it is not possible, in the majority of cases, to arrest it by ligation. The simple tying of a mass of the exceedingly fragile tissue of the pancreas often results in the ligature cutting through, and consequently in a further onset of bleeding. The individual vessels in the gland cannot be secured. The only means of arrest of the hemorrhage is, therefore, the use of deep sutures of material, silk or catgut, sufficiently thick to prevent its cutting through the gland when the stitch is drawn tight. And this method in itself is unsatisfactory, for it causes, necessarily, such damage by compression and strangling of the soft gland substance that sloughing is not unlikely to occur.

The second refers to **the escape of the pancreatic juice.** It has been shown, both by experimental work and by observations made upon cases submitted to operation, that, after the pancreas has been incised, bruised, or torn, its special secretion is poured out from the wound surfaces. The experimental work of Simon Flexner, Biondi, Katz, and Winkler has shown that when the pancreas is so damaged, by injury, however produced, that its vitality is lowered there is an escape of the gland secretion into the parts around. The observations of Ruggi and Biondi and other operators who have removed parts of the gland for simple or malignant growths show that a free outpouring of secretion occurs from the cut surfaces. The result of this is that fat necrosis occurs, as well as an active digestion of the tissues with which the juice comes into contact. An acute inflammation of the pancreas, with or without hemorrhage, or subacute or chronic pancreatitis may thus result. In one case, recorded by Küster, an injury to the pancreas during the course of an operation was followed by fat necrosis. The digestion by the pancreatic juice so freely poured out results in the provision of an admirable culture-material for any organisms that may chance to be present. Infection of the wound area is almost inevitable to some extent in operations, necessarily difficult and prolonged, upon the pancreas. An infection that the healthy peritoneum could certainly deal with, becomes of the utmost virulence when an abundant food-supply for the organisms is present. As Mikulicz says, the secretion of the pancreas does not flood the peritoneal cavity in such quantities that it proves fatal by mere absorption; "it acts indirectly by reason of the local irritation of the peritoneum, in that it prepares a nutrient medium for bacterial invasion and makes infection extremely easy." It is almost certain that in all abdominal operations some germs enter the peritoneal cavity. When their numbers are few, the unharmed peritoneum can resist them without difficulty, but if the natural powers of resistance of the peritoneum are greatly reduced, they may be competent to produce an acute inflammation.

A further source of danger lies in the digestive action of the pancreatic juice upon the adhesions which the peritoneum produces. The outpouring of lymph is the chief means possessed by the peritoneum of protecting itself from harm; when the thick flakes of lymph are speedily digested by the pancreatic secretion, the avenue for a further extension of septic trouble is at once opened.

The secretion from the injured or inflamed pancreas is able, according to Mikulicz, to cause, in itself, a variety of aseptic peritonitis, which is followed by intestinal paralysis and obstruction.

The lesson to be drawn from these facts is that in all cases of operation upon the pancreas, where there is any likelihood of the escape of the secretion, free drainage should be provided. The escape of secretion from a wound of the pancreas can be prevented by accurate suture, and by the careful closure of the peritoneum over the wound in the gland. Successful cases where this has been performed are recorded by Ninni and Mayo Robson. If this sealing off cannot be secured, the need for drainage is imperative. Its value is well shown by the statistics given by Mikulicz. In twelve cases of injury to the pancreas, the result of blunt force, or stab or gunshot wounds, eight were drained, and of these six recovered; four were not drained, and the only one that recovered was that recorded by Ninni, in which the peritoneum was securely closed over the wound.

The peculiar difficulties and dangers attaching to operations upon the pancreas will, therefore, be readily understood. Bleeding is apt to occur, and is difficult to arrest. Escape of pancreatic juice is almost constant; it can produce an aseptic peritonitis, or digest adhesions poured out by the peritoneum for its own protection, or, finally, by acting upon the blood so constantly present, on the pancreas itself, and on all the parts around, a culture-medium is provided which is eminently suited to insure the very rapid growth of organisms.

ACUTE PANCREATITIS

Acute Hemorrhagic Pancreatitis

Indications for Surgical Treatment.—The sole indication necessary to warrant, nay, even to compel, surgical treatment in a case of acute pancreatitis is a diagnosis of the condition. The fact cannot be gainsaid that when the condition is recognized instant surgical treatment is the surest means, and the safest, of effecting relief, and of giving the most certain chance to the pancreas of recovery of its function. This is not to deny that cases of acute pancreatitis may recover apart from operative treatment; cases do, without doubt, so recover, as do patients afflicted with any form of abdominal catastrophe. But spontaneous recovery is so infrequent as to be negligible in any academic statement of the surgical position in such circumstances.

In acute pancreatitis early operation carried out with a full knowledge of the conditions calling for relief is imperatively necessary.

Surgical Treatment.—In many cases operation will be undertaken upon a diagnosis which is tentative only. The surgeon will have recognized that some catastrophe has occurred within the upper region of the abdomen, the exact nature of which may not be quite clear. The incision will, therefore, be made between the ensiform cartilage and the umbilicus, through the middle line or else to the right of it. As soon as the peritoneum is incised a thin, blood-stained, serous fluid will escape. The character of this fluid is such as, at once, to exclude some of the alternative diagnoses which may have been made —perforating ulcer of the stomach or duodenum, for example. The omentum, which will probably present in the wound, looks bruised, swollen and sodden in its upper part, and an examination of it will reveal the presence of the white or pale yellow speckles of fat necrosis. The discovery of these spots is quite enough to enable the surgeon instantly to recognize the nature of the disease, and to make the operation purposeful which, until this point, had been exploratory. An inspection of the gastrohepatic omentum, the stomach, duodenum, and gall-bladder, and bile-ducts is then made. The pancreas will be found engorged with blood, soft, swollen, and purplish in color. The surgical indication is then at once to afford relief to the pancreas, which is in a condition of phlegmon. The same measures are necessary as in phlegmonous inflammation elsewhere. The gland must be exposed freely, multiple punctures or small incisions or one long incision must be made into the gland, and free drainage must be secured.

The need for the complete relief of tension and the necessity for free drainage are indeed the circumstances of chief importance to be taken into account. A large gauze packing may be introduced through the anterior abdominal wound, with or without the largest rubber tube, or a second posterior incision may be made in the left costo-vertebral angle, and the pancreas exposed from behind, punctured freely, and large drainage-tubes introduced. In some cases both anterior and posterior drainage may be profitably established.

In a certain number of the cases gall-stones will be discovered when the gall-bladder is examined. These should be removed and the gall-bladder should be drained, if time permits.

The dependence of acute pancreatitis, in many cases, upon the blocking of the ampulla of Vater by a small calculus, as was first shown by Opie, is a circumstance to be borne in mind. In my experience this condition is found more commonly in the ultra-acute cases, and less commonly in the subacute cases, of gangrenous or suppurative pancreatitis. A search along the common duct in its entire length is, therefore, necessary, and if a stone be found therein, it is to be removed. Remembrance must always be had of the fact that the patient's condition is serious and the utmost speed consistent with satisfactory work is necessary.

This method of treatment—the free exposure of the pancreas, its puncture, and the provision of free drainage, followed or not, as may be deemed necessary, by cholecystotomy—is that which should always be followed. There were on record, according to Mikulicz, up to May, 1903, seventy-five cases of operation for acute pancreatitis. Of thirty-seven cases in which the pancreas was involved in the operative interference, twenty-five recovered; in forty-one where the pancreas was not touched, four cases recovered, and in all of these free peritoneal drainage was established. In one of these cases the intestine was drained by the performance of typhlotomy. If intestinal paralysis is a prominent feature in the case, this should certainly be done.

GANGRENOUS AND SUPPURATIVE PANCREATITIS, SUBACUTE PANCREATITIS

In gangrenous pancreatitis the same incision will be made as for acute hemorrhagic pancreatitis—an incision 4 or 5 inches long between the umbilicus and the ensiform cartilage in or near the middle line. When the abdomen is opened, it will generally be observed that the lesser sac is overfull and that there is a marked bulging forward above the lesser curvature of the stomach. The general peritoneal cavity is now securely walled off by a barrier of gauze pads which also cover the wound edges, in such manner as to prevent any soiling of the parts around.

The pancreas will be exposed in the majority of cases by tearing gently through the gastrohepatic omentum. It will then be obvious if one part rather than another of the pancreas is involved; and if a well-defined abscess cavity is located, it may be opened, after adequate protection of the peritoneal cavity has been assured; or the abdomen may be closed, and a posterior incision in the left (or occasionally in the right) costo-vertebral angle may be made, so that an adequate escape is afforded to the pus, without risk of contamination of the peritoneum. In the majority of cases, however, drainage from the front will be necessary. The contents of the abscess are not fetid, as a rule, and the pus, on examination, may be sterile. Very often little lumps of necrosed fat or portions of disintegrating pancreas may be found in it, and in some instances large grayish-black sloughs of the pancreas may be removed. The loss of even a large portion of the pancreas does not seem to lessen, at any rate, perceptibly, the chances of recovery of the patient. I know of two patients who are living and in perfectly good health, whose metabolism seems perfectly satisfactory, in whom at least one-third of the pancreas was removed as a slough.

The sloughs that I have seen are always deeply stained with altered blood-pigment, they are gray or grayish-black in color, and are clearly the result of a process exactly similar to that seen in acute hemorrhagic pancreatitis. The formation of the slough is the end condition, of which hemorrhagic infiltration is the earliest recognizable manifestation. Mayo Robson mentions that, in all, fourteen cases of abscess of the pancreas have been operated upon, with five deaths.

Free drainage being secured, the gauze barriers are removed, and the abdominal wound is partly closed.

CHRONIC PANCREATITIS

Indications for Operation.—The methods of surgical treatment in chronic pancreatitis may be described as direct and indirect; *direct*, when some source of offense, or of continued irritation,—a stone in the duct of Wirsung, a cyst of the pancreas, a neoplasm of the pancreas, or of the termination of its duct in the ampulla of Vater,—is present, and the gland itself or its duct is attacked; *indirect*, when the inflammatory condition is due to a stone in the ampulla of Vater, in the common bile-duct, or in any part of the bile-channels which excites and perpetuates the pancreatic inflammation by reason of the consecutive infection of the bile. In these circumstances the pancreas itself is not in any way concerned directly in the operative measures.

The surgical indications, therefore, are determined by the possibility of removing, by operation, any condition which is proving a constant source of irritation to the pancreas, These indications are met by the removal of stones from the duct of the pancreas or from the bile-channels, or by draining to the surface by means of the operation of cholecystotomy bile which is constantly infected.

The early recognition and treatment of chronic pancreatitis are of the first importance, for the disease, if left unchecked, may produce such a sclerosis of the gland that the whole of the secretory substance and all the islands of Langerhans may be destroyed. The result is diabetes which proves fatal. Even when operative treatment is adopted the condition may have progressed so far that nothing more can be done than to remove the cause of the disease and to prevent its increase, the damage already done to the gland being irreparable. In one case of my own where chronic inflammation of the whole of the gland was found, due almost certainly to a stone long impacted in the ampulla of Vater, which had escaped by the formation of a fistula between the lower end of the common duct and the duodenum, there was relief from cholecystotomy, followed by long drainage, but the patient died after three and a half years from diabetes.

Surgical Treatment.—The surgical treatment of the disease will necessarily vary according to its cause. If a stone be found in the common duct or in the duct of the pancreas, it must be removed.

If a gastric or duodenal ulcer be found, it must be treated by excision or gastro-enterostomy, as seems best. But the main indication to be fulfilled is drainage of the bile to the surface for such a length of time as will allow the ducts to free themselves from infection.

Drainage of the gall-bladder may be instituted either by the operation of *cholecystotomy* or by the operation of *cholecystenterostomy.* The former, for a variety of reasons, is to be preferred. By it, the bile is drained to the surface and the common duct, therefore, is empty. After the operation of cholecystenterostomy bile may flow into the intestine through the new opening, but intestinal contents may also pass into the gall-bladder and increase the infection which it was the purpose of the operation to relieve. When cholecystenterostomy is performed in the manner already described, with a simultaneous lateral anastomosis, or exclusion of the intestine, the risk of this infection is lessened considerably, but is not abolished.

The operation of choice in chronic pancreatitis consists, therefore, in the removal of the cause, and in the institution of drainage to the surface of the bile, by the performance of cholecystotomy, or by direct drainage of the hepatic duct by choledochotomy. The result of these operations is most satisfactory if treatment is not too long delayed. A perfect recovery may be expected in the very great majority of cases. But if long-standing infection is discovered, the damage already inflicted upon the liver, the ducts, and the pancreas may be irreparable, and cirrhosis of the liver or sclerosing pancreatitis may remain, and may, in the end, prove fatal.

The mortality of the operation, judging by all recorded cases, is about 10 to 12 per cent.; but many of the patients were desperately, almost hopelessly, ill. A mortality not exceeding about 5 per cent. is what may be reasonably expected in the future.

CYSTS OF THE PANCREAS

For the purposes of operations of all kinds the pancreas may be approached from the front or from behind. In the great majority of cases the former route is preferable.

Approach from the Front.—A sand-bag having been placed behind the lower part of the chest, the abdomen is opened by an incision between the ensiform cartilage and the umbilicus, in the middle line, or to one or other side of it, as seems necessary for speedy access to the part to be treated. When the peritoneal cavity is opened, the pancreas may be reached in four ways: (*a*) above the stomach, through the gastrohepatic omentum; (*b*) through the stomach, both walls being incised; (*c*) below the stomach through the gastrocolic omentum; (*d*) through the transverse mesocolon.

(*a*) *Above the Stomach.*—In thin people in whom visceral prolapse is present the pancreas may often be recognized on palpation as a mass lying tranvsersely a little above the umbilicus. Indeed, a mistaken diagnosis of tumor in the stomach has not seldom been made in these circumstances. If the abdomen of such a patient be opened, the pancreas can be seen quite clearly through the thin diaphanous gastro-hepatic omentum. A small incision through this omentum, rapidly enlarged, will then give easy access to the gland.

(*b*) *Through the Stomach.*—This method is one which, so far as I am aware, has been deliberately undertaken on only one occasion. The operator was Hagen, and the case concerned a boy aged thirteen, in whose abdomen a cyst the size of a child's head was discovered. It lay behind the stomach and was surrounded by such strong adhesions that it was impossible to bring it to the abdominal wall. The anterior wall of the stomach was incised, therefore, and subsequently the posterior wall, and the cyst contents were then readily evacuated. The flaccid wall of the cyst was then, with great difficulty and after displacement of the stomach and resection of the costal margin, brought into contact with the parietal peritoneum.

(*c*) *Below the Stomach.*—This is the route which has been chosen by the majority of operators. A bloodless spot in the omentum immediately below the greater curvature of the stomach is selected and a small tear therein is made, and slowly enlarged. The lesser sac of the peritoneum is thus opened, and through the posterior wall of this sac the pancreas can be reached. If a cyst of the pancreas be present, it will often be found to bulge forward below the stomach and to be reached very readily by an opening made in the position described.

(*d*) *Through the Transverse Mesocolon.*—The omentum and the transverse colon are turned upward, as in the performance of the operation of gastro-enterostomy. The transverse mesocolon is then incised in a spot devoid of blood-vessels; a finger is passed through into the lesser sac, and the opening gradually enlarged by gentle tearing. This route is that to which the preference is given by Krönlein; but it is obvious that if drainage is necessary it is unsatisfactory.

Approach from Behind.—The pancreas may be reached by an incision in the left loin, commencing at the tip of the twelfth rib and extending obliquely forward to the umbilicus. Peters has operated in this way upon a hydatid cyst of the tail of the pancreas, and in several cases supplementary drainage, in cases of acute or subacute pancreatitis, has been established.

The gland having been exposed by one of these methods, the position, size, and connections of the cyst are closely examined, and the surgeon determines upon the operation to be carried out, in the particular circumstances disclosed. The choice will rest between two operations:

1. **Excision and Drainage of Cyst** ("*Marsupialization*").—This operation is far more frequently practised than any other. The cyst being exposed, its outer surface is stitched to the parietal peritoneum, before or after the contents have been emptied by aspiration. When the suture is completed, an incision is made into the cyst and a large drainage-tube is introduced. If possible, the cyst should be

treated like the gall-bladder in the operation of cholecystotomy, the tube being surrounded by a purse-string suture, which prevents leakage. The contents of the cyst pass along the tube and are collected in a bottle by the patient's side. If the secretion from the cyst is formed over the skin, it may digest the epidermis, producing a raw, red excoriation, which is excessively tender and irritable. There is no solution. A sinus may discharge for months, but eventually heals quite satisfactorily.

2. **Complete extirpation of the cyst** should never be practised unless the cyst is quite free from adhesions and its pedicle extremely small—conditions which are seldom present.

PANCREATIC CALCULUS

Very few cases of pancreatic calculus have been treated surgically, and only one case is recorded where a successful operation was performed after an accurate diagnosis had been made.*

The difficulties in the way of successful surgical treatment are the difficulty of diagnosis, which, though great, is not insuperable, and the multiplicity of the stones.

There are two routes by which a stone lying in the duct of the pancreas may be reached:

(*a*) By direct incision of the gland over the stone, followed by suture of the wound.

(*b*) By opening the duodenum, exposing the papilla of Vater, incising this and passing a scoop or a pair of fine forceps along the duct.

It is important to remember that calculi in the pancreas are often multiple, and that, therefore, the surgeon must not rest content with the removal of the first stone encountered.

(*a*) The easiest method of access to the body of the gland is to incise the gastrohepatic omentum, to pull the stomach downward and to the left, and so to bring the pancreas into view. The sandbag beneath the back will project the gland forward and bring it, therefore, much nearer to the surface. The gland being exposed and the stone located, the peritoneum is carefully protected by the double layer of gauze swabs in the usual manner. This is especially necessary in operations upon the pancreas on account of the character of its secretion, and the known liability of serious changes in the parts around, such as digestion and infection, to occur. The peritoneum of the posterior wall of the lesser sac is divided carefully, and the pancreas is then incised directly on to the stone, any bleeding points being at once seized, and the calculus is removed. The escape of blood or secretion is very carefully prevented by free mopping with dry swabs. The incision in the gland is then carefully sutured with catgut, and the overlying peritoneum drawn into careful apposition with a fine catgut or Pagenstecher suture. Drainage should be provided in all cases.

(*b*) The removal of the stone through the duodenum is carried out in precisely the same manner as in the operation of duodenocholedochotomy.

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* See Lancet, August, 1902.

NEOPLASMS

The treatment of malignant disease of the pancreas by the surgeon can hardly be said to exist. It is true that recently Franke* has related three cases in which malignant tumors of the gland were removed, but two of the patients died as a result of the operation, and in the third case the patient lived only five months. In this last case it is said that the whole pancreas was removed, but a careful reading of the original account does not convince one that this was done. I have elsewhere collected the records of all cases operated upon, thirteen in number. They all serve to show that the mechanical difficulties of the operation are well-nigh insuperable, and that if boldness and good fortune are the operator's gifts, the result to the patient hardly justifies the means.

The only circumstances in which the removal of solid tumors from the pancreas would seem to be feasible are these: (*a*) Where the tumor is pedunculated; (*b*) when it can be enucleated; (*c*) when it occupies the tail of the gland or the part of the body adjacent thereto; (*d*) when the vascular adhesions are not so numerous or so complex as to make the mechanical difficulties almost insuperable.

The question as to palliative operations in carcinoma of the head of the gland has still to be considered. It might be supposed that since many of the symptoms, jaundice and itching (sometimes absolutely maddening), are due to the hindrance to the free outflow of bile, an operation destined to divert the current of bile would afford relief. Such operations as cholecystotomy and cholecystenterostomy have been practised on many occasions, and with almost uniformly bad results. The risk of the most trifling exploration in such cases seems to be very great; so far as can be gaged from statistics of published cases, it is at least 60 to 70 per cent. The risks of either cholecystotomy or cholecystenterostomy are even greater than this. Murphy had ten deaths in twelve operations of cholecystenterostomy, and the experience of others is equally unfavorable. Palliative operations, therefore, are to be condemned; in part because of their great risk, in part because of the lack of any benefit therefrom. The only circumstance justifying an exploration is the existence of doubt as to the exact nature of the disease. When there is a well-founded suspicion that chronic pancreatitis is present, an exploration followed, if thought necessary, by the drainage of the gall-bladder may be performed.

The simple (non-malignant) tumors that have been dealt with by operation are so few in number that detailed mention is unnecessary.

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* Archiv f. klin. Chir., Bd. lxiv, 1901.

VISCEROPTOSIS

By Joseph Sailer, M.D.

Glénard's disease is one of the difficult subjects of internal medicine, and has, since the original paper of its discoverer, been a much-debated subject. The reason for this is found in the nature of the condition. According to the original idea of Glénard, it was merely a variety of neurasthenia associated with more or less ptosis of some of the abdominal organs. Later he changed his views considerably, and seemed to regard the involvement of the liver as one of the most important factors, and speaks constantly in his writings of hepatism as a more or less synonymous term. The numerous and careful studies of the displacements of the abdominal organs that have been made in recent years have served to indicate that there are many factors involved, and indeed the variety of disturbances that may be associated with these displacements are very numerous. Stiller * in particular calls attention to the frequency of other anomalies in the body, particularly of the skeleton, which he believes must be congenital. Others have called attention to the frequency of the mechanical effects of these displacements, and still others to the results of certain muscular changes and defects of nutrition, all of which may contribute to the morbid manifestations that are exhibited by these patients.

It is quite impossible to give any accurate classification of the various disorders associated with the displacement of the abdominal viscera, but this much at least may be said: First, splanchnoptosis may exist in many cases as an anatomic condition without giving rise to any disturbance of the health, and cannot therefore be spoken of as a disease.† This is often the case in elderly persons, and, as far as I know, there is no satisfactory explanation. In these cases, however, clinicians have come to recognize that it constitutes a factor that may, upon the development of other conditions, contribute to render those conditions more severe, or, by producing alterations in the nutrition, add an additional factor to the general morbid state. Under these circumstances it may be regarded as a predisposing cause, and its recognition is of importance for the purpose of employing such prophylactic measures as may be indicated to prevent the occurrence of those mechanical disturbances which may be associated with splanchnoptosis. Second, there may be a form in which, without particular involvement either of the gastro-intestinal tract or of the other abdominal organs, the patient exhibits that somewhat ill-defined

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* Stiller: Arch. f. Verdauung., 1896, ii, 281.

† Kund Faber Hospitalatidende No. 27, 1908. Abs. Arch. f. Verdauung., 1909, xv, 135.

group of symptoms to which the term neurasthenia has been applied. Under these circumstances splanchnoptosis may have nothing to do with the neurasthenic manifestation, but the frequency with which it occurs in these cases leads, I believe, to the very justifiable conclusion, either that it is a congenital condition associated with other vices of conformation that lead more directly to the neurasthenic manifestations, or is in some ill-understood manner in part responsible for them. Third, there is a group in which the splanchnoptosis may be regarded as secondary to other conditions that are more directly responsible for the disturbance of health, but possibly after it has developed it contributes to the accentuation of these manifestations. Such is particularly that large group in which, as a result of emaciation or distention of the abdominal wall, the natural support furnished by the abdominal fat and the abdominal muscles to the viscera of the abdominal cavity has been lost, with the result that displacements have occurred. Fourth, there can be recognized very distinctly a large variety of conditions in which the displacements are the mechanical causes of various conditions that interfere with health; that is to say, splanchnoptosis constitutes a purely mechanical factor in the production of disease. To this group belong the various signs of obstruction in the gastro-intestinal canal, such as retention of the stomach-contents, possibly associated with or leading to atony, and in the more severe cases also to dilatation; obstruction in the intestinal tract, leading to various manifestations of that rather uncertain condition known as intestinal indigestion; and particularly interference with the movements of the colon, giving rise to more or less obstinate forms of constipation; also those rarer conditions in which, as a result of tension upon the gall-ducts, jaundice may occur accompanied by signs of biliary colic, or obstruction of the vessels of the kidneys, giving rise to Dietl's crises. In women there may also be a variety of conditions associated with the genitalia, particularly prolapse of the uterus, that is not infrequently found associated with a more or less general splanchnoptosis. Fifth, these displacements are occasionally associated, either accidentally or causally, with chronic inflammation of the peritoneum, giving rise to adhesions that may produce more or less profound disturbance of the functions of the abdominal organs.

In his original paper Glénard* states that in many cases of neurasthenia a careful physical examination of the patient will reveal certain definite anatomic changes. These he evidently regarded more in the light of neurasthenic stigmata than as actual causes of the symptoms, although he recognized very clearly the disturbance produced by the displacement of the organs, and the resulting partial mechanical obstruction to the onward course of the contents of the alimentary tract.

The principal physical signs, he believed, could be placed in four groups: First, flaccidity of the abdominal wall and diminution of the abdominal tension, producing various alterations in the superficial appearance of the abdomen. Second, prolapse of the abdominal contents, involving primarily the lowering of the intestinal mass, or enteroptosis, which occurs in one-third of all cases; the downward displacement of the liver, or hepatoptosis, which occurs in 4.5 per cent. of all cases; and, finally, displacement downward of the spleen, which occurs in about 0.5 per cent. of all cases. Third, there is narrowness of the colon, probably due to contraction or enterostenosis. Fourth, atony of the stomach, with downward displacement of the whole organ, or gastroptosis.

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* Glénard: La Semaine Médicale, 1885.

These changes involve diminution of the lumen or atresia of the intestinal canal, weakness of the pyloric and colic ligaments, allowing the hepatic flexure of the colon to sink, with the result that the stomach is obliged to support the entire weight of the transverse colon. This prolapse of the colon pulls down the stomach and interferes with its evacuation, and contributes to the gastroptosis and to the gastric atony. In consequence the patient has pain and vomiting, less food is taken, and not all of it assimilated, so that the patient is starved and emaciated. There is constipation and the enterostenosis is increased.

It will be seen from this that Glénard * regards as the most important lesion the sinking down of the hepatic flexure. This may be the primary lesion, the more common form of the condition, or it may be secondary, as a result of the gastric atony and the failure of the stomach to support the remaining portion of the transverse colon.

Splanchnoptosis is more common in women than in men. It frequently follows childbirth, but may also be produced by injury, dyspepsia, local inflammation, or rapid emaciation. Glénard believes that pressure upon the liver by the corset or that violent effort may also produce it.

In discussing the treatment he mentions practically all the medicinal measures that are employed at the present day. These are: supporting the abdominal contents by a hypogastric belt; increasing the tension of the abdominal walls by a binder; increasing the nutrition by a concentrated diet; by the employment of hydrotherapy, massage, and physical and psychic hygienic measures. For the purpose of fulfilling the latter indications he advocates strongly the rest cure of Weir Mitchell as by far the most efficient measure at our command. He discusses all the conditions for which these patients are usually treated before the gastroptosis is recognized.

I have purposely made a long abstract of Glénard's articles because he was not only the first to call attention to the importance of the visceral ptoses, but also because in them the subject is so thoroughly and exhaustively discussed that but little has really been added to it by subsequent writers, except the suggestion and performance of various surgical measures designed to relieve the purely mechanical conditions.

The etiology of splanchnoptosis is a question of much dispute; a dispute, however, that has more to do with casuistry than practical

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* Glénard: "Les Ptoses Viscerales," Paris, 1899.

medicine, for there is a general agreement concerning the chief active etiologic factors. Glénard first believed that the displacement of the hepatic flexure of the colon was of the utmost importance; it was probably the first structure to descend, and by its descent entailed the descent of the stomach, of the intestines, and ultimately of the other organs. Later his views were much modified, and when his attention became fixed upon the liver as the important organ, its ptosis, enlargement, etc., giving rise to most of the other changes, he considered the prolapsed hepatic flexure as of less significance. It followed from this that the condition might be regarded as in part acquired. Stiller* in 1896 actively opposed this opinion. He urged the congenital nature particularly, because he had often noted that the tenth ribs were loose, and he regarded the costa decima fluctuans as a stigma neurasthenica or enteroptica, although the absence of this sign does not necessarily indicate acquired splanchnoptosis. He believed the order of frequency of the lesions to be ptosis and atonic dilatation of the stomach; ptosis of the colon, especially of the transverse colon, of the kidney, either the right or both, and rarely of the liver and spleen. The disease depends upon a congenital malformation occurring chiefly in narrow-chested persons, and therefore corsets, child-bearing, and acute or chronic injury must be regarded merely as accidental factors. This view was vigorously combated by Zweig,† who, basing his opinion particularly upon clinical work, reached very different conclusions. Thus, in fifty males a free tenth rib occurred in twenty-three; in fifty females, in twenty-seven. Classifying his cases, he found that in nervous dyspeptics free tenth rib occurred in 65 per cent., in enteroptosis in 67 per cent., in other conditions in 34 per cent. Rather than regard the free tenth rib as a stigma, he quotes with approval the opinion of Tandler: "It is a well-known anatomic fact that our ribs are undergoing a process of simplification in a caudocranial direction. To this process of simplification belongs the detachment of the ribs. In many individuals this process is already complete. The free tenth rib is therefore not a pathologic costa decima fluctuans. It is not a sign of degeneration, nor of atavism, but, on the contrary, it is an anthropomorphic stigma, a sign of development." He quotes Meinert, who in one hundred consecutive autopsies found movable tenth rib in no fewer than ninety-seven. He therefore concludes that a floating tenth rib is neither a contributing sign of a nervous gastric disorder, nor a certain stigma neurasthenica. Albu,‡ however, believes that in 90 per cent. of all cases visceral ptosis is the anatomic expression of a special form of body development, which may be regarded as a depreciative variety of the normal type; in other words, a degenerative variety, which he names the typus paralytica, or, after its most distinguished delineator, the typus Botticelli.

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* Stiller: Loc. cit.

† Zweig: "Gesammelte Beiträge aus dem Gebiete der Physiologie, Pathologie und Therapie," herausg. von Boas, p. 281.

‡ Albu: Berlin. klin. Woch., No. 7, 1909, p. 289.

There is little doubt in my mind that splanchnoptosis occurs very early in life. I have observed it in children as early as the second year, and often have been able to determine the existence of the same condition in the mother, indicating the possibility of the hereditary transmission of the anatomic defect, if it can properly be called such. On the other hand, I have observed in all these cases in young children a moderate degree of diastasis of the recti, a rather pendulous abdomen, and other changes that suggest rachitis, so that I have come to suspect that the rachitic condition may have something to do with the displacement of the abdominal viscera. Albu has also observed it in early life, and has even recognized it frequently in the new-born, although he states that it is 30 per cent. less frequent than in adults. Just what part the relatively large size of the liver in infants may play in this apparent displacement downward of the other organs giving rise to an apparent visceral ptosis can be determined only by continued observation of certain cases. Sarégé* contributes some statistics on this subject in his article on Nephroptosis.

It has already been pointed out by Glénard that this displacement is usually found in the narrow-chested persons with an acute intercostal angle, and Bonniger,† in a series of measurements upon three hundred healthy adults, found that the elongated ptosed stomach occurred in women with the paralytic habitus. It is obvious when we speak of splanchnoptosis that there can be no actual dropping of the abdominal viscera, leaving a space beneath the diaphragm, but rather that there is merely a rearrangement, and the displacement is relative and determined only by the comparison of the position of the viscera with certain abdominal landmarks, such as the borders of the ribs, the umbilicus, the crests and spines of the ilia, and the symphysis pubis. The contraction of the lower portion of the thoracic cavity necessarily diminishes the infradiaphragmatic space. This crowds the organs downward, causing a compensatory distention of the abdomen, and probably some stretching of the muscles of the abdominal wall, and it is only from some such conception as this that I can bring myself clearly to understand the nature of this condition. I am therefore inclined to believe that if some fundamental causative factor is to be found, it must include the diminution of the infradiaphragmatic space. Of course, this may conceivably be brought about in other ways, particularly by the enlargement of the liver or the dilatation of the stomach, but I have been led to believe that the chief factor, especially in those cases that can be recognized in the young, is a deformity of the lower portion of the thorax, and this deformity is usually of a rachitic nature. I cannot therefore agree with Zweig that the condition of the skeleton is of little importance, nor am I inclined to agree wholly with Stiller and Albu that it is commonly a congenital condition; in other words, that it exists in the beginning of the differentiation of the embryonic tissues. Lennhoff* has studied the changes in the configuration of the body and endeavored to express them by a mathematical formula which he calls the body-index. This is obtained by dividing the distance from the jugulum to the symphysis by the least circumference of the abdomen and multiplying by one hundred. Gastroptosis is usually found associated with high indices. Albu states that the height of the body is greater than the distance between the outstretched arms, the trunk is long, the bones slender, there is contraction of the lower part of the thorax, and the pelvis is of the infantile type. Quincke† regards the constriction of the waist, such as occurs in the cylindric paralytic type of thorax, as one of the most important anatomic factors.

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* Sarégé: Journal de médecine de Bordeaux, 1904, Nos. 21 and 22.

† Bonniger: Berlin. klin. Woch., No. 10, 1910.

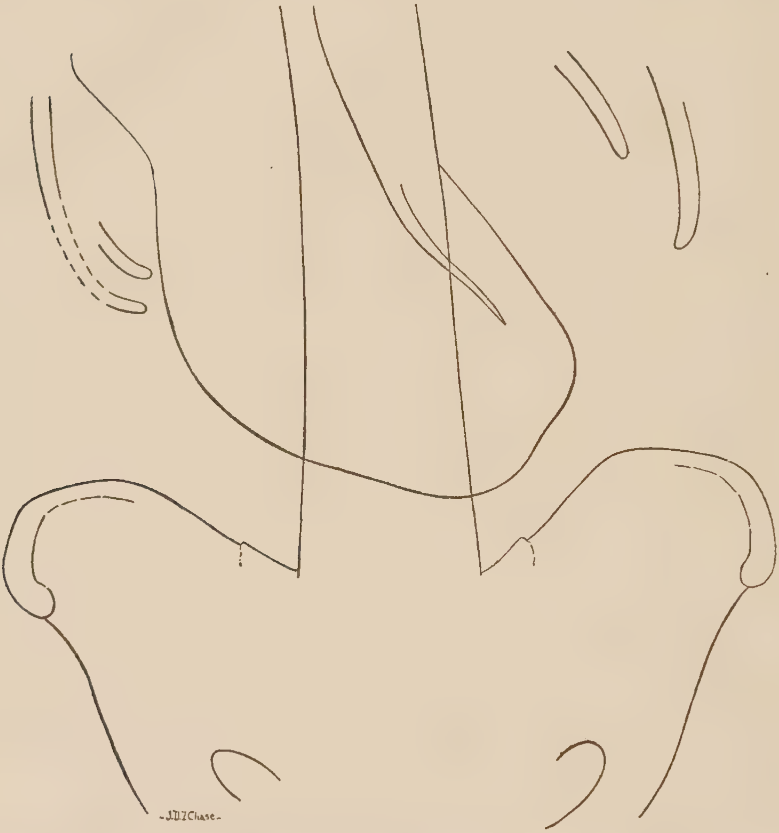

Fig. 25.—Outline of ptosed and dilated stomach, showing a sharp kink in the lesser curvature, which may be responsible for the obstruction. Picture is reversed.

Certain factors have generally been recognized as belonging to the group of exciting causes. Among these are relaxation of the abdominal wall, either from weakness, as in wasting disease, or as a result of overdistention following pregnancy, ascites, and large removable abdominal tumors, and also the loss of abdominal fat, and it is not the absence of fat, but its rapid disappearance, that occasions the descent of the organs. To these may be added chronic constipation, it being supposed that the overloaded transverse colon drags upon the stomach and causes it to descend. Finally, it is asserted that gastroptosis may occur as a result of sudden and violent muscular strain, injury, etc., although the means by which they produce these results is by no means clear. In some cases, undoubtedly, the violent muscular strain may simply act by producing enough additional displacement, which in most cases need be only very slight, to cause

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* Lennhoff: Berlin. klin. Woch., No. 9, 1909.
† Quincke: Therapie der Gegenwart, 1905, No. 1.

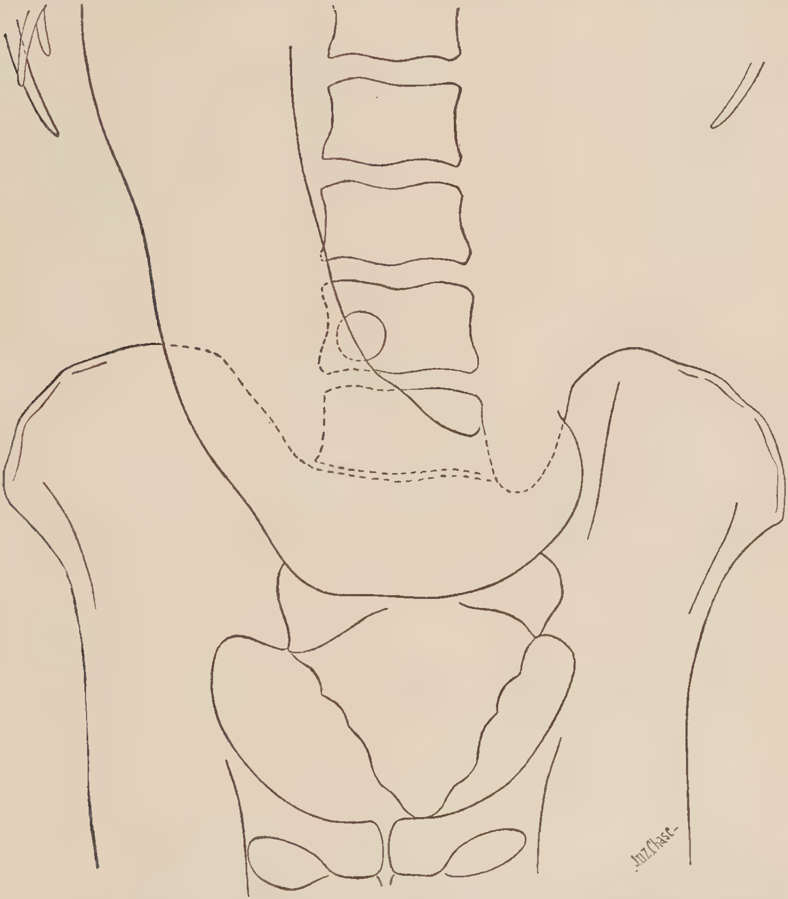

Fig. 26.—Outline of ptosed and dilated stomach. In this patient there was an unusual degree of retention with submotility. Such a case cannot be relieved by mechanical measures.

symptoms of obstruction to occur in a patient who had previously had splanchnoptosis without clinical symptoms. Thus, in one of my patients, a tall, slender woman with a long, narrow thorax, no symptoms appeared until after running for a considerable distance in an effort to catch a train. An *x*-ray showed that the stomach extended to the brim of the pelvis, and all the other abdominal organs were also displaced downward, including the hepatic flexure, which was at the level of the umbilicus with no bending of the ascending colon, and it is inconceivable that the displacements could all have occurred subsequent to the exertion.

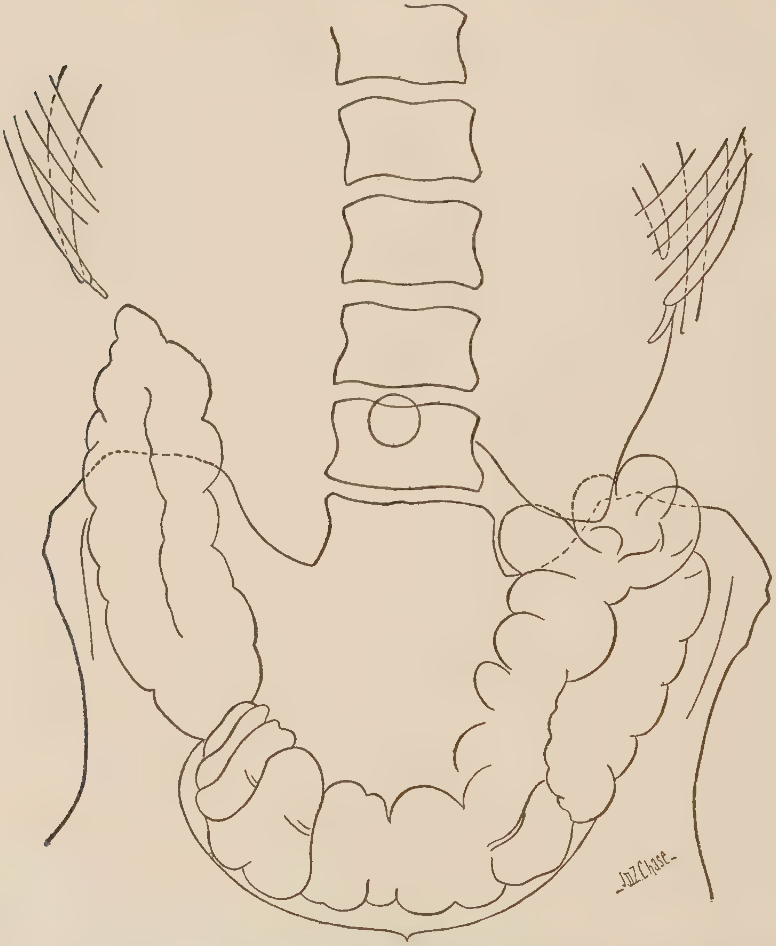

Fig. 27.—Complete prolapse of transverse colon with sharp angulation at both hepatic and splenic flexures. This may be accountable for the extreme constipation.

The subjective symptoms are varied. In general, it may be said that they are the symptoms of neurasthenia of a most persistent type, with which are associated various symptoms due to mechanical obstruction, such as discomfort in the epigastrium, nausea, discomfort in the intestines due perhaps to distention or to intestinal indigestion, and possibly, as Glénard insists, vague symptoms associated with impairment of the functions of the liver. The neurasthenic symptoms are always vague. Primarily they are those of fatigue after moderate exertion, indisposition to effort, either mental or physical, a tendency to doze while at work, often curiously enough associated with insomnia at night, irritability, depression which may almost amount to melancholia, apprehension of both mental and physical insufficiency, a desire to escape from human fellowship, palpitation of the heart, and other

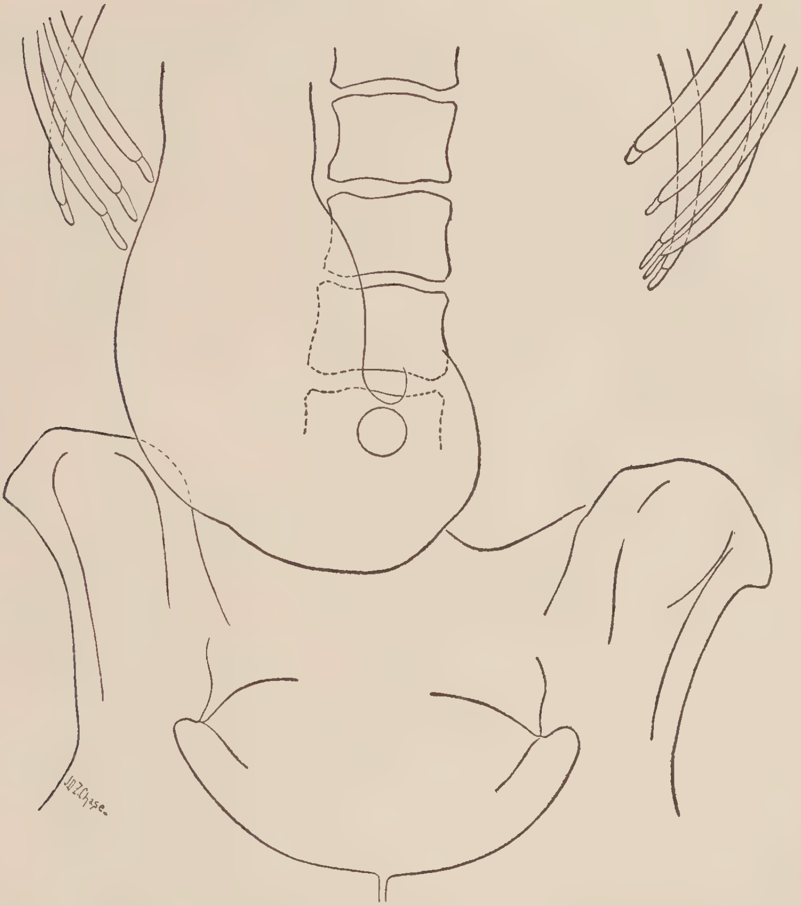

Fig. 28.—Moderate ptosis and moderate dilatation. This patient suffers from retention and has been benefited by mechanical support. There is probably an organic stricture either in the stomach or in the duodenum.

symptoms of disability difficult either to describe or to classify and varying considerably in different cases.

The objective symptoms are more distinct. There may be vomiting if the gastric retention is pronounced. Constipation is almost the rule, and rarely there is jaundice. Few patients suffering from splanchnoptosis are in a state of good nutrition. Occasionally there are disturbances of urination, and in women quite frequently disorders of menstruation and the pains ascribed to displacements of the uterus. The objective signs are more distinct; emaciation, a narrow thorax, a depression in the epigastrium, visible pulsation in the epigastrium, the relaxed abdominal walls with protrusion of the lower portion of the abdomen, which is usually pendulous, a sallow skin, and a haggard

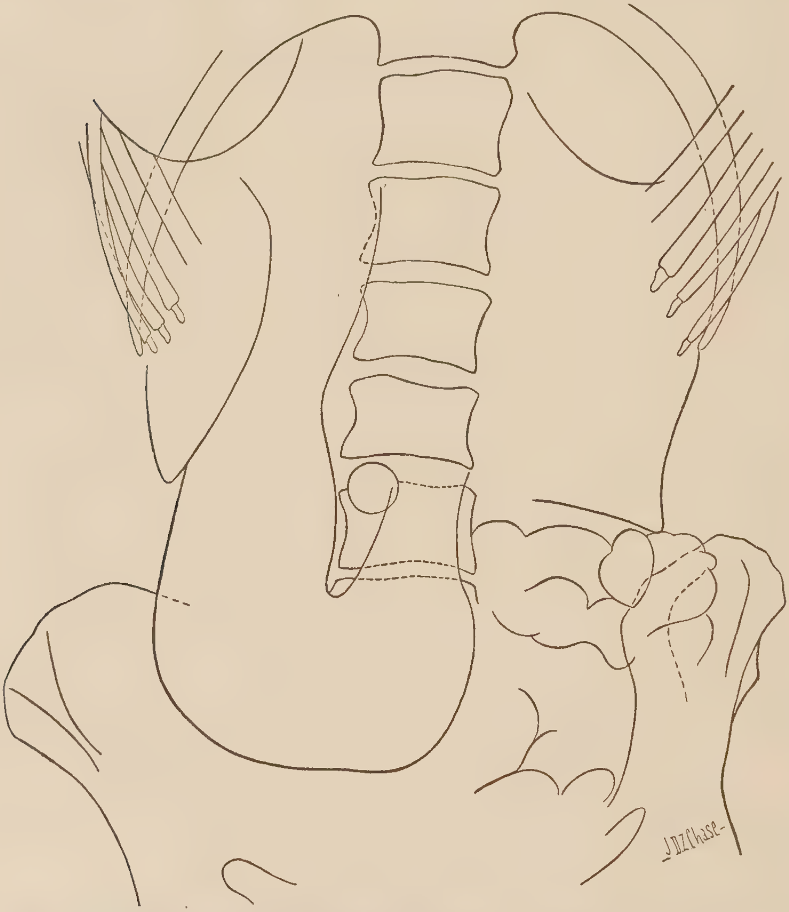

Fig. 29.—Extreme ptosis of the stomach and ptosis of the liver, spleen, and hepatic flexure. There is moderately sharp angulation of the lesser curvature. This patient should be relieved by mechanical support.

expression, are all characteristics described by Glénard, which, as Stiller says, almost enable one to make the diagnosis at a glance. More careful inspection will often show a slight separation of the recti, that occurs not infrequently in men and in women who have not borne children. The umbilicus often appears as if dragged downward by an internal tug that Glénard believes to be due to the round ligament of the liver. Quite commonly the right kidney is palpable and moves freely with respiration, and careful palpation will reveal contracted segments of the colon, particularly the cecum, sigmoid, and less frequently the transverse colon. Much stress has been laid upon the audible splash that can be elicited in the epigastrium. This has been

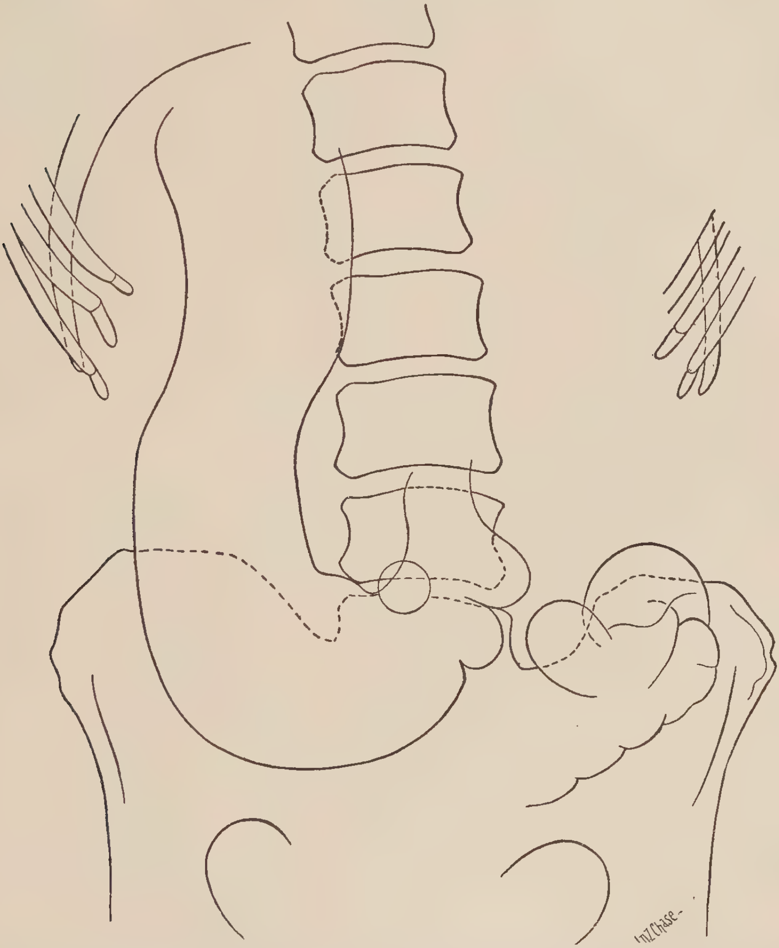

Fig. 30.—An almost vertical stomach, showing moderate degree of ptosis and also ptosis of the hepatic flexure. This case is also suitable for mechanical support.

developed particularly by Glénard as a means of diagnosing accurately all sorts of conditions and positions of the stomach, but other observers have been unable to confirm his views. Personally, I have come to regard it merely as an indication that the stomach contains both liquid and gas, and as of the same significance as, although perhaps less definite than, the information obtained regarding the contents of the stomach by the use of the stomach-tube. The various methods

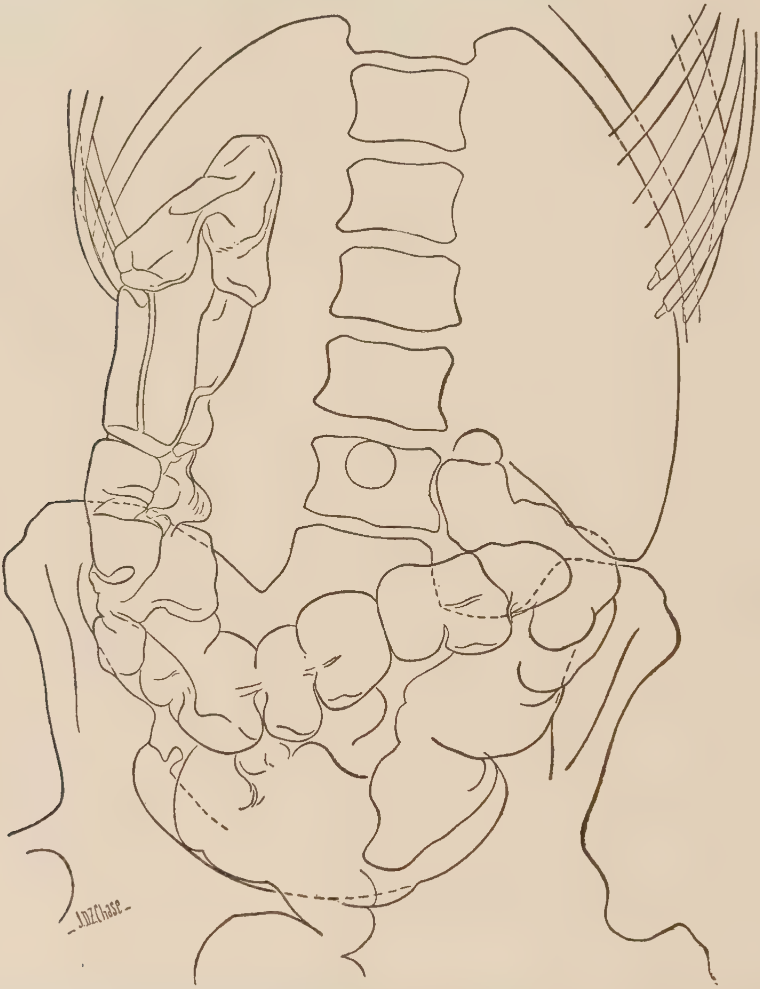

Fig. 31.—A case of cæcum mobile. This patient has ptosis of the liver and a very low hepatic flexure. The splenic flexure is in good position. The cecum is enlarged, ptosed, and somewhat tender. She has had operations for appendicitis and gall-stones, and the findings at both accorded with diagnosis. She is almost completely relieved by the application of adhesive plaster. She has hitherto been unable to find any other form of support satisfactory.

that have been devised for the purpose of determining the position of the stomach are of great importance. Only the more important ones can be mentioned, and it is not in place here to describe them fully. They are, first, inspection, the outlines of the stomach often being clearly visible in extremely emaciated subjects, but rarely unless there is some dilatation. Second, palpation, various observers claiming the ability to palpate both curvatures of the stomach in a few cases. The ptosed pylorus can occasionally be felt, and may be recognized as a small mass about the size of a hazelnut that undergoes periodic relaxation. It is usually from 2 to 7 cm. above the umbilicus (Obrastow,* P. Cohnheim,† Hansman,‡ Sacconaghi§). Third, percussion, either direct, mediate, or in a modified form of auscultatory stroking percussion, or by the transmission to the ear through the stethoscope placed below the ribs on the left side of the vibrations of a tuning-fork. The latter appears to be the least misleading. Fourth, inflation, either by carbon dioxid evolved in the stomach or by the introduction of air through the stomach-tube. Both methods are accurate, as in also the auscultatory inflation practised by Musser. Fifth, various procedures, grouped together for convenience, that require more or less apparatus. Among these are the gastrodiaphane, the sound containing a hard round end that may be felt through the abdominal wall, and the sound containing an electromagnet whose position is determined by a dipping compass placed over the abdominal wall. These are all more serviceable for clinical demonstration than in active practice. Sixth, the Röntgen ray. Our accurate knowledge of the position and the size of the stomach has been acquired since the employment of this method, and it is practically indispensable. The clinical methods for determining the position of the small intestines are not at present satisfactory unless there are obstruction of the ileum and visible peristalsis. The *x*-ray never gives a clear picture of the normal small intestines except the first portion of the duodenum. For determining the position of the colon, various methods are also employed: inspection serves in cases of obstruction; palpation is satisfactory if the portions are contracted or contain fecal accumulations or liquid and gas: auscultation is rarely of service except in cases of obstruction with distention above the stricture; inflation is useful in selected cases; and finally the *x*-ray, when skilfully used, will give an almost perfect picture of the whole outline of the large bowel.

The frequency of the displacement of the various organs is not a matter of much importance, although a considerable amount of study has been devoted to it. Albu|| gives the following table of percentages obtained from the observation of 3400 adults and 94 new-born children:

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* Obrastow: Deut. med. Woch., No. 43, 1902.

† P. Cohnheim: Deut. Arch. f. klin. Med., 1903, lxxviii, 291.

‡ Hansman: Archiv f. Verdauung., 1907, xiii, 394; Berlin. klin. Woch., No. 44, 1903.

§ Sacconaghi: "Anleitungen zur Diagnostik der abdominal Tumoren," Berlin, 1910.

|| Albu: Loc. cit.

	Adults		New-born	
	Males	Females	Males	Females
General splanchnoptosis	21	68	11	44
Floating tenth rib	10	57	9	38
Nephroptosis dexter	21	68	11	44
Nephroptosis sinister	4	11	4	27
Hepatoptosis	9	17	5	9
Splenoptosis	2	6	3	3
Gastroptosis Enteroptosis	19	59	8	15

In 50 per cent. of school-children suffering from a disturbance of nutrition a floating kidney is present.

TREATMENT

Satisfactory indications for the treatment of visceroptosis are not easy to obtain. It must be kept clearly in mind that splanchnoptosis, although an abnormal condition, may nevertheless be compatible with perfect nutrition and unimpaired health; that the neurasthenic manifestations may exist with the displacement of the abdominal organs and nevertheless be entirely independent of them, so that the mechanical treatment of the displacement in such cases is neither indicated nor beneficial; that, even if in part depending upon the displacement of the abdominal organs, the neurasthenia demands consideration apart from them, and therefore treatment directed only to their reposition will be inadequate. The same is true of malnutrition. This may be due entirely to mechanical impediments in the gastro-intestinal tract, and it will be promptly relieved when they are corrected. On the other hand, it may be due to other causes of a totally different character. Thus, in a case of extreme splanchnoptosis the patient was extremely emaciated, but the emaciation had commenced only with the onset of a severe diabetes, from which the patient ultimately died, and although the splanchnoptosis, which was only partly explained by the loss of fat, must have existed for many years, no symptoms directly depending upon it could be discovered.

Further difficulty exists in the fact that as a result of mechanical defects secondary secretory and perhaps motor disturbances may develop, that persist after the mechanical defects have been relieved. Thus, in gastroptosis with retention there is frequently hyperchlorhydria, and this hyperchlorhydria persists even after a gastro-enterostomy has been performed, relieving the retention; and gastric catarrh is so common and so persistent that it must be regarded less as a part of the disease than as a serious complication. Constipation also may not be relieved by abdominal support, by improvement in nutrition, or even by operative correction of defects in the position of the colon.

More definite indications are those disorders which are directly traceable to mechanical defects. Among these are the signs of gastric retention, discomfort for considerable periods of time after the ingestion of food, regurgitation, vomiting, signs of fermentation, such as bloating, eructation, etc., constipation, either chronic or alternating with diarrhea, and inflammatory conditions in the intestinal tract which may be ascribed in part to the stagnation of the intestinal contents, and I have been particularly impressed with the relative frequency of the chronic forms of appendicitis in these conditions. There are also the more acute manifestations, such as the results of ptosis of the liver with attacks of biliary colic and jaundice, the Dietl's crises occurring in ptosis of the kidney, and the pain and discomfort which are frequently ascribed to undue mobility or ptosis of this organ. In regard to the latter, I am rather in accord with Stiller, who believes that operation for the fixation of a ptosed kidney is frequently unsuccessful, because the symptoms which it is designed to relieve are incorrectly ascribed to this organ.

As in all other conditions, we may recognize two forms of treatment: first, prophylactic; second, corrective.

Prophylactic treatment is indicated (Roux,* Sarégé,† Albu‡) in those conditions in which displacement of the abdominal organs exists without the production of any or only slight clinical signs. According to Albu, a palpable kidney is found in 50 per cent. of the school-children of Berlin that suffer from disturbance of nutrition. The treatment is practically restricted to displacements discovered in young children, and is purely hygienic. It consists first in efforts to replace the abdominal organs without apparatus. Pfahler has shown the extraordinary influence of the muscles of the abdominal wall in elevating the intra-abdominal viscera, and therefore a child should be given a course of exercises designed to strengthen particularly the abdominal muscles. No general directions for these can be given. It must be remembered that any form of exercise that develops the muscles of the body in general will have a good effect upon those of the abdomen. Therefore as far as possible a vigorous outdoor life should be urged. There are, of course, certain exercises that are of advantage, and these should be given under the direction either of some one trained in orthopedic methods of exercises or of a director of physical education, or even perhaps of the intelligent director of a gymnasium. It is important, of course, to provide exercises that are not irksome, but rather such as afford as much pleasure as possible to the child while performing them. The diet should be rational, and it seems better in these cases to give food at frequent intervals rather than to permit the child to overload the stomach once or twice in the course of the day. Constipation should be avoided, and if possible without resort to laxatives. It is of great importance also to see that the children are not obliged to sit for long periods of the day in school in cramped positions on uncomfortable chairs or benches, that their position while at the desk does not cause relaxation of the abdominal muscles, and that they are not overstimulated by their teachers to devote themselves too intensely to their studies. The ordinary hygienic rules are important—plenty of sleep, well-ventilated rooms, cleanliness of the skin, and particular attention to the cleanliness of the mouth as a possible source of some of the minor infections of the stomach. The removal of adenoids and enlarged tonsils, by promoting the general health, is also of benefit. And if, after some prolonged infectious condition, the child has become emaciated, convalescence should be more prolonged and more carefully guarded than in normal children. In young girls particular care should be taken at the period of puberty, and during menstruation they should have adequate rest, and as far as possible freedom from anxiety. In young adults similar measures may be employed if, for any reason, splanchnoptosis has been discovered, or if, after some of the slighter manifestations of the condition have been corrected, the patient has apparently been restored to health. Roux advocates the substitution of a hypogastric corset for the usual form in young girls.

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* Roux: "Manuel des Maladies du Tube Digestif," Paris, 1907, i, 533.
† Sarégé: Loc. cit.
‡ Albu: Loc. cit.

The corrective treatment of the condition has for its object the meeting of certain definite indications. Those originally formulated by Glénard, and subsequently reiterated by Mathieu, are four, the first three being concerned directly with disturbance of the alimentary tract, and the last particularly with the nervous system. They are, first, the replacement, partial or complete, of the dislocated abdominal organs; second, the improvement in nutrition; third, the elimination of constipation; fourth, the treatment of the neurasthenic state. It is obvious that there is considerable overlapping in the various methods used for meeting the first three indications, and that the improvement of all of these has a tendency to correct the neurasthenic condition. The replacement of the abdominal organs improves the nutrition by facilitating the evacuation of the stomach, and relieves the constipation by supporting the intestines and removing the suspected intestinal kinks. The improvement of nutrition, on the other hand, tends, by increasing the intra-abdominal fat, to elevate the abdominal organs, and, by increasing the muscular strength, to improve the support furnished by the muscles in the walls of the abdomen. Finally, the correction of the constipation may aid the nutrition, partly by facilitating the assimilation of food, partly perhaps by diminishing or eliminating a toxemic condition that theoretically may be produced by the stagnation of the intestinal contents.

As I know of no better classification of the indications than that given by Glénard, I shall follow it in the description of the treatment.

First, measures employed for raising the abdominal viscera. Of these, the simplest is postural treatment. Frequently in gastroptosis considerable relief is experienced if the patient lies down for half an hour or more after the ingestion of a meal. It has been shown by the *x*-ray that the stomach is so apt to rise in the abdomen when the patient assumes the horizontal position that practically very little information regarding its exact position can then be obtained. It must, of course, be noted that the pictures thus obtained are not absolutely conclusive, because it is not certain that the bismuth reaches the lowest part of the stomach. Nevertheless, it is conceivable that if the drag upon the pyloric portion of the stomach by the contents can be prevented or neutralized, then moderate muscular contractions may serve to evacuate the stomach, and at the same time the duodenal kink or the interference with the motility of the pylorus by the sharp angulation of the lesser curvature may be eliminated. Empirically, the method is of great service, and serves to contribute, with other measures, to the improvement of nutrition. It is doubtful whether the attempt to tilt the lower part of the body by lying with a pillow under the hips is of any particular advantage. It may be employed if it causes no discomfort, but otherwise should not be attempted. There is more doubt about the value of the knee-chest posture, assumed two or three times a day. Gynecologists consider it of advantage in cases of prolapse of the uterus, and there is no reason to suppose that it is of less advantage in ptosis of the other abdominal organs, but its effects can only be transient, and it can be justifiable only if there is concurrently a rapid gain in weight. Various exercises designed particularly to improve the abdominal muscles are also of service. Among these may be mentioned: first, lying flat upon the floor, with the hands above the head; the legs are slowly lifted, being held straight at the knees until they are perpendicular to the body. They are then lowered slowly, deep inspirations and expirations being taken during the downward movement; second, lying flat on the floor, with the hands above the head, the patient slowly rises to a sitting posture and slowly lies down again without lifting the feet from the floor. It may be necessary to have the feet held either by a companion or by catching them under the edge of a piece of furniture while this exercise is being taken. Another very useful exercise is one employed in the German army. It is rather difficult and apt to be fatiguing at first. The patient stands upon one leg, while the other, with the knee stiff, is held in a horizontal position in front for ten seconds. Then the same exercise is immediately done with the other leg. The tension of the abdominal muscles and their continual play during this exercise can readily be detected by placing the hand on the abdomen. Other exercises consist of standing with the feet well separated, lifting the arms above the head moderately separated, so that the muscles of the chest dilate the lower part of the thorax as much as possible; the body is then bent back while a deep inspiration is taken, then slowly brought forward while expiring. This exercise should be repeated a number of times both night and morning. It is probably improved by using pulley-weights, the rope passing over pulleys placed considerably above the patient's head. Of the mechanical means of exercise, the horse, parallel bars, and the horizontal bar are apparently the most useful, but climbing the rope and swinging on the rungs of a ladder are also of advantage. These exercises are, of course, adapted only for fairly vigorous young adults. For older persons milder exercises under the guidance of a trainer, and mild outdoor sports, such as golf, are the most useful. For young persons the best outdoor sports are apparently tennis and canoeing; the latter should be done according to the method of the guides, kneeling in the bottom of the canoe, and not sitting on a seat fastened to the gunwales.

The second method of readjusting the abdominal viscera is by the application of mechanical support. As has already been said, this is not wholly synonymous with lifting the abdominal viscera, but actually it involves so changing the shape of the abdominal cavity that these viscera assume a somewhat different relation to the bony landmarks and in part to each other. It is accomplished chiefly by changing the shape of the muscular abdominal walls so that the lower portion of the abdomen is contracted and the upper portion becomes fuller, and therefore, to a certain extent, an actual elevation does occur. While the view was prevalent that the descent of the abdominal viscera was the chief factor in the disorders occasioned, it seemed the most obvious method, and the results of its employment in many cases justified the belief in its efficiency, although Roux contends that it should be regarded merely as a palliative measure. It is accomplished by the application of binders. These are of three kinds: First, adhesive straps, whose employment has been advocated most vigorously by A. Rose, to whom is due very largely the credit for their success. Second, the application of binders. Chronologically, these should come first. The varieties that have been devised are legion. Third, the application of some more or less resistant support to the abdominal wall, such as the prolongation of the corset or an abdominal plate. These, of course, in a certain sense, are really modifications of the binder. Of all forms, the adhesive straps are the most efficient. They mold themselves closely to the contour of the body, they do not slip, and practically any reasonable degree of pressure and support may be obtained. They may be applied in a great number of ways. I have used several methods extensively, and with the exception of certain disadvantages, which will be discussed later, all of them are satisfactory. The method that I have finally come to believe is the most useful is as follows:

Two to six straps are prepared, 2 or 3 inches in width and of such length that they will pass more than half-way around the body. During their application the patient should stand and the skin should be bared from the middle of the thorax to the symphysis pubis. The first strip is placed so that the end overlaps the median line just above the symphysis. It is carried upward and outward obliquely, passing above the crest of the pelvis and crossing the spinal column in the back. No tension should be made. The second strip is then placed symmetrically around the other side, the ends overlapping the first both in front and in back. Both strips are then detached as far as the median axillary line, and as much tension as possible is made on the first, at the same time supporting the abdomen in front with the hand. It is then fastened firmly to the back and held by an assistant, while a similar maneuver is made with the other strip. Care should be taken that there is no curling of the lower edge where it passes just above the crest of the ilium. The third strip is placed parallel to the first and above it, the edges overlapping for about 1 inch, and it is applied in the same way. The fourth is placed symmetrically to the third. The fifth strip overlaps the third again by an inch. The sixth overlaps the fourth. Often two straps, 3 or 4 inches broad, are sufficient. In this way a sort of spica bandage composed of adhesive straps is applied to the abdomen, and the test of its successful application is the bulging of the epigastric region and the increase of the waist measure by 1 or 2 inches. At first there is a feeling of stiffness, but often as soon as the bandage is applied also one of considerable support. The stiffness soon wears off, and as a rule the patients express themselves as feeling a lightness and ease of movement that they had not hitherto possessed. In applying this bandage the services of an assistant are of advantage, but are not absolutely necessary. There is no danger of making too much traction, and practically as much force as possible should be employed. In order to do this it is desirable to have the patients support themselves by placing the hands upon a mantelpiece or against the wall. Occasionally it is desirable to put a transverse strip across the lower edge to keep the first two strips flat and in perfect contact with the skin. Otherwise they may curl upward and leave the lowest portion of the abdomen unsupported. It may also be desirable to place one or two transverse strips across the back to keep the ends from separating and permitting the tension to relax.

Another excellent method is devised by Rose.* He prefers to apply the plaster with the patient lying down, and his procedure is as follows:

A strip of adhesive plaster about 7 inches wide and long enough to encircle the abdomen and cross in the back is taken. From the middle of the lower edge two lines are drawn extending obliquely upward to two points on the ends 2 or 3 inches from the upper edge. These lines should be slightly convex upward. The bandage is then cut along these lines and is then in three pieces. The point on the lower edge is now applied just above the symphysis pubis, the plaster carried around the body, and the ends overlapped in the back. The two side-pieces are placed with their larger ends to either side of the symphysis, so that they overlap, and are carried obliquely upward and backward, crossing in the back and reinforcing the lower edge of the larger strip. Fig. 32, which is taken from Rose, will make this method clear. Occasionally the wide pieces may be applied first and the main piece last. In any event, Rose recommends applying an additional strip across the front to hold the lower edge of the bandage down, and occasionally this should extend along the edge of the whole binder. It is sometimes applied while the patient is in the Trendelenburg position. A third method has been devised by Rosewater.*

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* Rose and Kemp: "Atonia Gastrica."

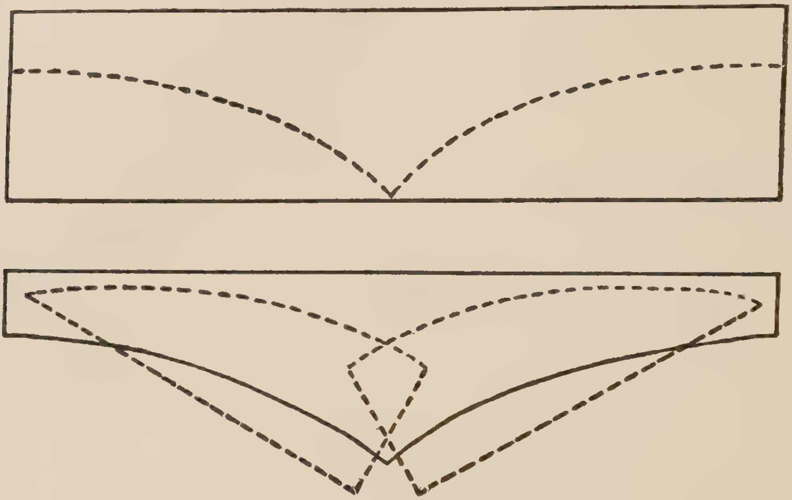

Fig. 32.—Rose's method of cutting and applying plaster bandage.

This consists of a broad strip of plaster passing from the symphysis to the sternum. Two broad strips are then passed obliquely around the lower part of the abdomen, overlapping in front and back, very much as the strips one and two of the spica that I employ. Finally, a fourth broad strip is passed tightly around the lower portion of the abdomen, the upper edge below the crests of the ilium and the ends overlapping in the back. While this is being applied, the abdominal viscera should be firmly pressed upward. Various modifications of these adhesive straps have been devised by different clinicians, but as they all seek to produce the same effect, that is, they all involve the same principle, space cannot be spared for their individual description. Essentially all forms consist of strips passing obliquely around the abdomen from the region of the symphysis upward and backward, crossing in front and back. A possible exception may be made in the

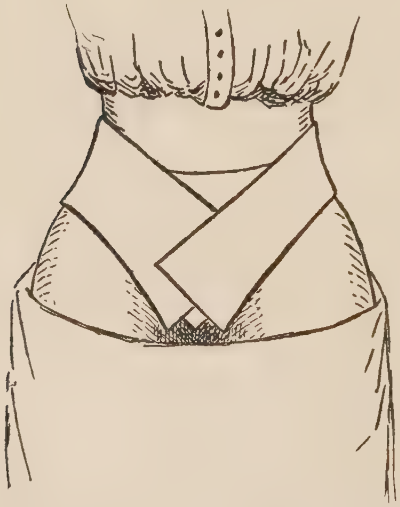

Fig. 33.—Appearance of plaster bandage upon the abdomen.

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* Rose and Kemp: Loc. cit.

case of the fourth strip of Rosewater's, which, instead of lifting, directly compresses the lower part of the abdomen.

The disadvantages of the plaster bandages are numerous. These are, first, deficient adhesion; the ends of the bandage are apt gradually to slide either along the skin or over each other, giving rise to diminished tension and lack of support. The amount of this slip can readily be seen by noting the blackened area on the underlying bandage or skin produced by the accumulation of dirt on the gummy material left uncovered. This sometimes amounts to half an inch or more. The edges of the bandage may curl and cut into the skin, causing considerable discomfort. There may be a very considerable amount of irritation of the skin, giving rise to a mild form of dermatitis with considerable itching. The plaster may cause some cracking in the skin and the cracks may bleed and, becoming infected, cause intense discomfort. Finally, the removal of the bandage is often attended with a good deal of suffering. To obviate these defects Kemp made some experiments, first, to determine the best type of adhesive substance, and, second, to determine the best material upon which to spread it. He reached the conclusion that the best adhesive substance is the ordinary plaster mass used in zinc oxid rubber plaster; that the best material upon which to spread it is goldbeater's skin, or, as it is called when used for this purpose, moleskin; and he has therefore had manufactured a moleskin plaster that he has used with considerable success. The advantages of the moleskin are that, being soft and pliable and nevertheless strong, it molds itself perfectly to the body and exerts a firm pressure. In order to avoid as much as possible the irritation of the skin, it is desirable that the plaster be applied to skin that is perfectly dry and, as far as possible, free from hair. In very hairy persons it may be necessary to shave the wall of the abdomen, and this should be done by an expert, otherwise the surface may be made tender. The skin should then be thoroughly washed, dried, and freed from grease by washing with ether. A moleskin plaster after this preparation may be worn for several weeks without any appreciable discomfort, and, owing to the character of the rubber plaster, the patient can take a tub-bath as often as may be deemed desirable, the only precaution being that the water should not be so hot as to induce active sweating, which may also take place beneath the plaster, and not only loosen it, but, as a result of the action of the retained salt, cause considerable irritation of the skin. The removal of the plaster can, as a rule, be readily accomplished by using ether. The end of the plaster should be soaked with ether and then, when it has been detached, a pad of cotton saturated with ether can be used to dissect it away from the skin. Ordinarily this means dissecting the plaster mass from the material upon which it is laid, but the former can then readily be scrubbed off the skin with an ether swab. Moistening the plaster with some essential oil may also considerably facilitate its removal.

x-Rays taken of the stomach before and after the application of the plaster fail to show any very marked elevation, and it is not clearly explained as yet just how the support does good, but, as has already been said, the empiric results are satisfactory.

The number of abdominal binders is practically limitless, but those which are useful may be divided into two main groups: first, the binders that compress the lower portion of the abdomen, and therefore crowd the intestinal contents into the upper portion; second, those which aim to take the place of the adhesive straps and in a sense lift up the lower portion of the abdomen. The best type of the first of these is the original binder devised by Glénard, and it aims to accomplish the same thing that Rosewater aims to accomplish by the fourth strip. It consists of a simple straight piece of some non-elastic material, 6 or 7 inches wide, that fits closely around the abdomen and fastens in the back by a series of buckles. These should be so adjusted that the bandage can be tightened in any part as much as may be desired. The binder passes around the body so that the lower edge is just above the symphysis pubis, and remains parallel with the ground when the patient is standing. It crosses over the trochanters of the femur and the sacrum and is buckled in the back. As, under ordinary conditions, it would slip up to the smaller portion of the abdomen, it is kept down by two pieces of tape that are attached in front to either side of the symphysis, passing under the groin in the gluteal fold, and are attached posteriorly to the edges of the binder in about the neighborhood of the posterior superior spines of the ilium. This bandage has great advantages. It is remarkably efficient and gives a sense of great relief, part of which I have always believed is due to its admirable support of the pelvic bones. It is very light, because it can be made of some comparatively light material, such as muslin or linen, and it is very cheap, all the material required for its construction being readily purchased for 50 cents, and it can be made by any woman reasonably skilful in the use of the needle, as practically the only things required are the hems at the edges, the attachment of the straps and buckles, and the attachment of the straps passing under the thighs. It has certain disadvantages. It is apt to wrinkle. This can be obviated very readily, however, by inserting a few strips of whalebone at various points along its course: two in front and two in the back are usually sufficient for this purpose. Whalebones on the sides press upon the crests of the ilium, and may cause discomfort. The thigh strips may cause irritation. This can be relieved by making them of some soft material, such as silk ribbon, or, better still, of tape, and slipping over the tape some rubber tubing. If these tubes are kept well dusted with talcum powder, the irritation is reduced to a minimum. The binder interferes somewhat with the movements of the thighs; less so, however, than would be supposed when it is seen in place. The greatest disadvantage lies in the fact that it is practically of no value in very thin persons, because in them the ilia are so prominent that very little support is afforded to the anterior wall of the abdomen. The modifications of this binder have been largely modifications of material, and a binder made of the material used for saddle-girths is very satisfactory, because it is stiff enough not to wrinkle and firm enough to give excellent support, but it has the disadvantage of being rather warm and heavy. Sometimes in thin persons the binders are reinforced by a pad in front, in order to give the requisite pressure against the lower part of the abdomen. This is rarely successful, but occasionally does seem to afford additional relief. As a rule, the pad is best made of silk and stuffed with the best quality of horsehair, such as is used by upholsterers.

Of the binders that aim to support and lift the abdomen, there are two types, one in which the support is furnished by the binder itself, and the other in which a strap is used to reinforce the binder, that in this case acts merely as a garment to which the strap is attached. Of the former type, I believe that there exists no satisfactory model on the market. The reason for this is that each binder must be carefully fitted to the wearer, and this can only be done by a reasonably expert dressmaker. Unless it is properly fitted, it is neither comfortable nor efficient. Naturally, for a binder of this type there can be no routine pattern, and it is difficult to give any general description, but the principle upon which it is based is as follows:

The binder consists of four parts—the front, the back, and the two sides. The front covers the lower part of the abdomen from the symphysis to a little above the umbilicus. The back is applied over the lumbar region and the two sides connect these parts. The front and back are approximately rectangular quadrilaterals. The anterior and posterior edges of the two side-pieces are perpendicular when the patient is standing, and the other edges are oblique, so that the general shape is that of a rhomboid. The lower edge of the two side-pieces usually lies below the crest of the ilium and has to be fitted carefully so that undue pressure is not made over the bony prominences. The bandage may lace either in the back or in front, and is prevented from wrinkling or curling by the introduction of suitable pieces of whalebone. It is particularly important that whalebones be placed on either side of each row of eyelets. The material of which this binder is made is not of great significance. Muslin, linen, silk, and linen mesh are all satisfactory, but as nearly as I can learn from my patients the linen mesh is, on the whole, the least uncomfortable. As it has a tendency to stretch, it is necessary to reinforce it with tape. The bandage must often be altered several times before it fits perfectly, and it is nearly always necessary to instruct the patient how to put it on, because a bandage may, if put on carelessly, be exceedingly uncomfortable and useless as a support. Usually it is sufficient if it is laced tightly from below upward, and the patient learns to lift the abdomen after the lower part has been laced, so that it is held in this position.

Of the binders depending upon straps, the most satisfactory is that devised by Dr. Storm. It is comfortable and usually gives adequate support. Wholly to be avoided are the abdominal binders usually supplied by the truss- and instrument-makers that are convex outward and therefore have no lifting power, and, as they are generally kept in stock, rarely fit the patient comfortably. They are probably more efficient in other conditions than in gastroptosis.

A number of efforts have been made to modify the binder, either by making it of elastic material, as suggested by Teufel, or by the introduction of a pad or plate, as in the binder of Landau and Bardenheuer. To my mind none of these is satisfactory. The elastic binder has indeed certain elements of danger, because, as the pressure is uniform and not greater below than above, and as, indeed, unless the binder is very skilfully fitted, it may be greater above than below, there is as much danger of crowding the organs downward as there is likelihood of supporting them at a higher level. Pads have a tendency to exercise localized pressure, which, as Quincke* points out, may interfere with peristalsis and, as I have found in some cases, rather serve to prevent the organs from rising than act as any support; for it is obvious that the isolated lifting of any one or two structures is of no advantage, and that the support must come wholly from the tissues below, as occurs under normal conditions. It has been claimed, particularly for the pad, that it is of service in those persons who are so thin that no binder exerts pressure upon the lower part of the abdomen, but even in these cases I have seen no relief from its use, and I am inclined to think that if the plaster cannot be worn, it is desirable to attempt to increase the weight by a thorough rest-cure rather than to attempt ambulant treatment.

Of late years the so-called straight-front corset has been employed considerably. Its use was first advocated by Clyde, who devised a binder into which he introduced steel springs for the purpose of making it exert more pressure upon and adapting it more closely to the abdominal surface. Later Gallant † studied the subject on a large clinical material with considerable care. He lays down the following rules, to which all such corsets should conform, and which are so admirable that they leave nothing to be desired. Somewhat abbreviated, they are as follows:

1. The corset must conform to the latest fashion.
2. It must reach low and fit snugly around the hips, stretching from one anterior superior spine to the other.
3. The circumference must be according to that of the natural waist, but the corset must curve in well at the sides.
4. The upper portion must accurately fit the thorax, and in front ample room must be provided for the replaced stomach.
5. Below the waist the corset must be inelastic. Above the waist it must permit free play to every motion of the trunk.
6. Hair pads must be used over the hips in thin women.
7. It must be laced firmly below.

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* Quincke: Centralbl. f. innere Med., 1905, p. 1067.

† Gallant: Jour. Amer. Med. Assoc., Nov. 7, 1908; Medical Record, No. 27, 1907.

8. The most important condition of all. It must be made, fitted, and adjusted with the same care and attention to detail as an orthopedic apparatus.

9. The woman must be taught how to put on and wear these corsets. The corset should be put on with the patient lying on the back.

In properly selected cases and if properly made this corset appears to be an ideal method of treatment, having the disadvantage, however, that it tends rather to diminish than to increase the functional activity of the muscles of the wall of the abdomen. A variety of other corsets have been put upon the market by various manufacturers, but as they are usually sold ready-made or selected from stock to fit the patient as nearly as possible, they are apt to be unsatisfactory.

Not every case is suitable for the employment of a binder. Among the contraindications are: (1) The existence of any inflammatory lesion within the abdominal cavity. Of these lesions, it has been my experience that chronic appendicitis is the most common, and in several instances I have discovered that I had overlooked this condition, which had rendered futile mechanical support. Under this head may also be included (2) all forms of adhesions that prevent a free play of the abdominal viscera one upon the other. Often, of course, these cannot be recognized, but they should be suspected in rebellious cases. (3) Extreme ptosis is also a contraindication. If the stomach reaches the brim of the pelvis; if the kidney cannot be pushed upward, or only so short a distance that its upper pole can still be plainly felt; if the transverse colon lies upon the symphysis—no benefit will be derived from the binder, because it merely compresses and does not support the abdominal viscera. (4) Another contraindication is dilatation of the stomach associated with pyloric or duodenal stenosis. The objection to the binder in these cases is not so much because it may do harm, but rather because it cannot possibly be of any benefit. (5) In extremely thin persons whose abdomens when they are lying on the back are scaphoid, no form of binder is of any service, and merely compresses, as in cases of extreme ptosis, and, indeed, these emaciated persons often have extreme ptosis. Finally (6) the presence of abdominal neoplasms is obviously a contraindication. If these conditions can be excluded, the binder may be expected to give satisfactory results.

There is some choice in the type of binder. The Glénard binder is of most service in those persons whose abdomens are pendulous, the so-called laparoptosis, with a fair degree of fatty development. The adhesive straps are also useful in this condition, but particularly should be selected for moderately thin persons. The lifting binder is adapted for either the fat or the moderately thin person, but, it seems to me, works somewhat better for the latter, and is not surpassed in effectiveness by Glénard's binder. The corset is the most useful for moderately fat women or for those who have a pendulous abdomen and a weak back.

Next in order of the treatment of gastroptosis is the improvement of the general condition of the patient. While the mechanical support may be regarded as symptomatic, and only indirectly as curative, the improvement of nutrition may, as Einhorn * has shown, in a certain proportion of cases, relieve not only the symptoms, but also the anatomic displacement, and therefore may be looked upon as distinctly curative.† It cannot be said that the improvement of the nutrition of these patients differs in any essential respect from the improvement of nutrition of patients who are emaciated from any other cause, except that in the other cases we must direct our attention to the causative factor, and in splanchnoptosis, aside from the mechanical support needed by ambulant patients, this is not necessary.

In his original paper Glénard called attention to the value of the Weir Mitchell rest-cure for this purpose, and it is fair to say that since that method was devised, nothing superior to it has been suggested, nor have any additions been made which seem to be improvements, except that in the milder cases strict isolation is not required. The patient should remain in bed, should be given forced feeding, daily massage, and, in the extreme forms of emaciation, the muscles should be exercised by electricity. I believe for this purpose that the slowly interrupted faradic current is the most satisfactory. It is important, of course, to keep the patient occupied, and so to arrange the feeding, massage, and other procedures that the day is fully occupied and she has no time to indulge in morbid reflections upon the seriousness of her condition. This also has the advantage of making prolonged visits from relatives and friends difficult. My best success has been with patients removed from their homes, and this is particularly true of married women with families, for invariably at their homes they are annoyed with household cares. There need be little fear of overfeeding, for after correction of any gastric disturbance the amount that these patients can digest is extraordinary, and I have frequently given them the equivalent of four or five thousand calories per day without apparently producing any discomfort. As a rule, it is better to give meals at frequent intervals in smaller quantities,‡ than in large quantities two or three times a day, and I have adopted a dietary somewhat as follows, which, it should be understood, must be adapted to each particular individual:

7 A. M. Glass of milk and some crackers.
8.30 A. M. Breakfast consisting, except in the hyperacid cases, of fruit, cereal and cream, and two eggs.
10.30 A. M. Milk and zwieback.
1 P. M. Dinner, consisting of soup, meats, two vegetables, salad, and light dessert.
4 P. M. Some weak tea with cream and light cakes.
6.30 P. M. A light supper, consisting of milk-toast, oyster-stew, omelet, or any other acceptable food, followed by stewed fruit.
9.30 P. M. A glass of milk or a cup of cocoa or a small glass of cream with some crackers, and, if desired, some dried fruit, such as figs, dates, prunes.

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* Einhorn: Berlin. klin. Woch., 1906, No. 34.
† Von Noorden: Therapie der Gegenwart, Jan., 1910.
‡ Von Noorden: Loc. cit.

Occasionally it is desirable to awaken the patient about 3 A. M. for a glass of hot milk, or it can be kept by the bedside in a thermos bottle, to be given only if the patient awakens spontaneously. The other procedures can be arranged as follows:

9.30 A. M. A cleansing bath in bed.
3 P. M. A light general massage.
9 P. M. An alcohol rub. If the skin is dry, an oil rub can be substituted.

From 11 A. M. to 1 P. M. the windows should be opened and the room thoroughly aired, and this may be repeated between 5 and 6 P. M. After supper it is often of advantage to amuse the patient by reading or conversation until it is time for the luncheon at 9.30 P. M. Visitors may be admitted between 5 and 6, and the open windows prevent too prolonged a stay. Often, however, the patient prefers to doze during this period. If electricity is required, it may be given for fifteen minutes some time between 11 A. M. and 1 P. M.

It is practically useless to undertake a limited rest-cure. It should be understood from the beginning that it must continue for at least six weeks, and, preferably, unless the response is very satisfactory, for a longer interval. It is desirable to weigh the patient at the beginning of the cure, and then at intervals of not less than two weeks, and if no gain occurs during the first two weeks, no dissatisfaction should be felt, because very frequently this is a period of adaptation.

The management of the ambulant cases is much more difficult, and the results are, as a rule, somewhat slower. For this treatment only patients originally with a fair degree of nutrition, in whom a certain mechanical support can be employed, should be selected. If they continue their occupation, it is often inconvenient for them to obtain luncheon between meals, although occasionally it is possible to have a supply of milk and a box of crackers so that they can take a glass of milk at ten and at four. If this cannot be done, they may be given two raw eggs after each meal. Usually after a little practice there is no difficulty in swallowing them, and the added nutriment apparently does not disturb the appetite. If the eggs are not well taken, 2 to 4 drams of olive oil after each meal will supply a considerably larger number of calories, and the oil is of advantage in aiding to overcome gastric retention and constipation; or if the taste of the olive oil is objectional, sweet oil of almonds may be substituted. Often it is of advantage to give some bitter tonic before meals, such as nux vomica, gentian, or condurango, and it is important, if possible, that the patient should lie in a horizontal position for at least thirty minutes three times a day immediately after the principal meals.

Treatment of gastric retention—whether this be due, as I believe, in the majority of cases to obstruction resulting from a kink, or, as is maintained by others, who weighed the dried residue of the gastric contents, in considerable part to atony of the muscular wall * does not

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* Schirakauer: Deut. med. Woch., No. 35, 1907; Rosenberg: Berlin. klin. Woch., No. 39, 1906.

differ essentially from the treatment of retention in other conditions of the stomach, and it is therefore not necessary in this article to describe it in great detail. Aside from the benefit derived from the mechanical and postural measures employed and the modification of the diet, there are two measures which deserve consideration. The first is the use of oil, of which the method of administration has been described. The second is the employment of drugs. Of these, the most efficient are strychnin and physostigma, both of which are highly recommended by Von Noorden. He also advises pilocarpin, but I have had very little success from its use, although occasionally it has been beneficial in retention associated with deficient gastric secretion. Strychnin may be given in small doses, from $\frac{1}{80}$ to $\frac{1}{40}$ gr. three times a day after the chief meals. Physostigma or eserin may be used in doses of $\frac{1}{150}$ gr. in the same way. Lavage, as Boas* believes, gives at most only temporary relief.

Treatment of the secretory derangements may also be discussed very briefly. In the majority of cases there is hyperchlorhydria, but it seems to be rather a hyperchlorhydria of retention than of oversecretion. It may be treated dietetically partly by eliminating the acid foods, the condiments, and those proteids which contain a large amount of extractants; partly by increasing the frequency of the meals and diminishing the amount; and also by neutralization, the most valuable alkalis being the bicarbonate and carbonate of soda, the carbonate of calcium, the subcarbonate and subnitrate of bismuth, and the oxid and carbonate of magnesia. These may be combined in various ways, one of the salts of soda being quite sufficient in the uncomplicated cases, the bismuth salts being employed if there appears to be gastric hyperesthesia and the magnesium salts if there is constipation. Atropin may be employed to check the gastric secretion, and in cases of pyloric spasm to aid in the evacuation of the stomach-contents. In doses less than those sufficient to produce distinct physiologic effects it appears to be of little value, and the physiologic effects are, of course, too unpleasant to be borne for any length of time.

In the rare cases of hypermotility the meals may be made less frequent and bulkier, and small doses of codein or morphin, from $\frac{1}{24}$ to $\frac{1}{12}$ gr. of either, may also be administered. As soon as the hypermotility has been corrected, this should be withdrawn.

Subacidity requires the administration of hydrochloric acid. This, as Jaworski has shown, should be given before meals in adequate doses, well diluted in from 4 to 8 ounces of water. The diet needs practically no restriction, the heavier proteids are well digested, and the fruits and other acid articles of food are distinctly indicated.

Of the other gastric complications, the most important are pain or a sense of weight or heaviness in the epigastrium. This is often immediately relieved by the binder. If there is actual pain associated with tenderness, however, it suggests very strongly the existence of ulcer. If this—and it is rarely so—can be definitely excluded, relief may be afforded by bismuth, or in the severer cases small doses of cocain or beta-eucain. I prefer the latter, and regard $\frac{1}{10}$ gr. as the maximum permissible dose, to be used not oftener than five times a week. The sense of spasm may be so severe that it leads the patients to practise voluntary vomiting for its relief, and in this they often become expert. If they have been taught the use of the stomach-tube, however, they may practise frequent lavage. In some cases lavage is merely a vicious habit, and it is important to discriminate between the two types and to avoid prohibiting it if it is really necessary.

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* Boas: "Gesammelte Beiträge aus dem Gebiete der Physiologie, Pathologie, und Therapie."

Nausea and vomiting may also occur with varying frequency. If they are not relieved by the measures designed to overcome the gastroptosis, and are not due to a distinct organic obstruction, they are probably the result of secretory disturbance. For temporary relief a capsule containing beta-eucain and cerium oxalate may be given. Permanent relief depends upon the elimination of the cause. A case of tachycardia relieved by a binder, and therefore possibly due to splanchnoptosis, has been reported by Weinstein.* It must be a rare complication.

In a certain number of cases it will be necessary to consider the question of operative interference. The indications for this are: (1) failure of all other measures and the steady deterioration of the patient's condition; (2) signs of partial or complete obstruction of the intestinal tract; (3) excessive retention of the gastric contents. The first indication is necessarily more or less vague, because it is often difficult to be certain either if every reasonable device has been employed, or if one of those sudden and inexplicable periods of improvement may not be about to occur. Impairment of nutrition, persistent distress, and perhaps an exaggeration of some of the symptoms of splanchnoptosis may be regarded as suggesting the need of surgical interference.

This is not the proper place in which to speak of the type of operation to be employed, but I may express my opinion as an internist that the varieties of displacement in splanchnoptosis are so great, and the clinical symptoms that they produce are so variable, that no single type of operation will ever be applicable to all, or even to a considerable percentage of the cases. It has been my feeling that each case should be most carefully studied, all available information obtained, and, if possible, the exact nature of the operation to be performed determined before the incision is made. I have little faith in the decision, even of the most experienced surgeon, during the stress of the operation, and I have often felt that a better knowledge of the conditions likely to be found would have rendered possible more rational measures after the abdomen had been opened. The fault, I believe, has been partly with the internist, who is often unwilling to commit himself

* Weinstein: New York Med. Jour., Jan. 10, 1907.

to an exact diagnosis, partly to the surgeon, who commonly asserts that he will decide what ought to be done after he has seen the condition of the parts.

The diversity of conditions as met in splanchnoptosis does not prevent surgeons from devising routine operations for its relief, and it is perhaps not out of place to say that the various attempts to elevate the stomach do not seem to me reasonable, and that therefore its drainage must be promoted either by enlarging the pyloric opening or by performing a gastro-enterostomy. It must be remembered that these are not trifling operations, and in many cases are followed by sequels often difficult or impossible to correct, the most important being the various degrees and kinds of vicious circle that result from adhesions. I have referred a number of cases to the surgeons for operation, and in fourteen of which I have records two died—one of uremia and one as a result of uncontrollable vomiting due to obstruction; two have been completely relieved for a period of four and three years; one, a pyloroplasty, was entirely successful up to the time, three years after the operation, when I last heard of the patient. The others had more or less discomfort following the operation, which in a few has disappeared in the course of time. Three have required secondary operations to relieve adhesions, one of these three patients requiring six operations altogether of this nature.

My present attitude is that operative interference should not be undertaken lightly, and that the operation should be performed only by a thoroughly competent surgeon after consideration of the problems presented in the light of the information obtained by the clinician.

Ptosis of the small intestines apparently gives no definite symptoms. Obstruction rarely occurs from kink in this part of the bowel, at least it has not hitherto been recognized, nor do the *x*-ray pictures indicate any marked retention of the bismuth.

The ptoses of the colon have in recent years attracted considerable attention, and it is now recognized that they are responsible for many of the most serious symptoms, and particularly for the frequent constipation. Under normal conditions the contents of the ileum pass into the cecum, where they remain for considerable time, each new portion passing to the center of the mass and being gradually inspissated through the absorption of the fluid contents by the rich plexus of lymphatics in this portion of the bowel.* Apparently if any considerable quantity escapes into the transverse colon, it is returned to the ascending colon by the reverse peristalsis that Cannon has demonstrated. When finally it begins to pass over, it does so with considerable rapidity until it reaches the descending colon, where it accumulates in the sigmoid flexure and remains there, gradually hardening, until it reaches the rectum, when expulsive peristalsis is set up and it is discharged. It appears that the hepatic and splenic flexures act to a certain extent normally as valves separating this portion of the bowel into three parts, of which the first, or ascending colon, is usu-

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* Basler: Archiv f. die gesammte Physiologie, cxxviii, 251.

ally full, the second, or transverse colon, is usually empty, and the third, or descending colon and sigmoid flexure, contains a variable quantity of feces.* If, however, as a result of ptosis, the valve-like action of the flexures, particularly the splenic, becomes exaggerated, an accumulation may form in the transverse colon that can be felt as a cylindric mass, usually lying below the determined position of the greater curvature of the stomach. It moves freely and is rarely tender to touch. Possibly, as Glénard supposed, its weight acts as a drag, tending to pull the stomach lower, and thus to cause the colon to descend, accentuating the kink at the splenic flexure. Moreover, the existence of the kink gives rise in part to the constipation from which these patients suffer. It may therefore be concluded that the festooning of the transverse colon is one of the mechanical factors hindering the onward movement of the contents of the intestinal tract. The second factor is usually found in the sigmoid flexure. In many cases this appears to be of excessive size. Whether this is due merely to the fact that it compensates for a possible shortening of some of the other segments of the colon has not been determined by measurement, but much attention has been paid to the various positions that this elongated portion of the colon may assume. As a rule, it is shown either by dissection or by the *x*-ray to assume so contorted a position that it seems almost impossible that it should still act as an efficient channel for the feces.† The symptoms produced by these displacements of the colon are constipation, which may be the only one; a sense of vague but persistent and often disabling discomfort in the lower part of the abdomen; and attacks of acute pain, sometimes associated with transient diarrhea. These, as Klose,‡ Lardennois,§ and Hausmann‖ have shown, are apparently due most often to ptosis and motility of the cecum (cæcum mobile). The symptoms may resemble those of chronic appendicitis. Enterostenosis is common, and the contracted portions of the colon may often be felt, particularly in the iliac regions. Fecal tumors are often formed, the usual seats, in order of frequency, being the sigmoid flexure, the cecum, the descending colon, and the transverse colon.

The treatment of the constipation is one of the most difficult and unsatisfactory problems that the physician is compelled to undertake. It may be divided into general measures, laxatives, and enemata.

Of the general measures, those advocated for all forms of chronic constipation may be employed. The formation of habit, active exercises that involve the abdominal muscles, some modification of the diet, such as the use of fruits at bedtime, or the drinking of water before breakfast are of value, but it must be noted that the bulky anti-constipation diet of Von Noorden is not adapted to these patients.

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* Roith: Beiträge zur klin. Chirurgie, liv, 374; Mittheilungen aus den Grenzgebiete der Medizin und der Chirurgie, xix, 1908; Anatomische Hefte, xx, 1902.

† Tuttle: New York Med. Jour., No. 14, 1908.

‡ Klose: Beiträge zur klin. Chir., lxiii, 711.

§ Lardennois: La Presse médicale, No. 45, 1910.

‖ Hausmann: Loc. cit.

Of the laxatives, there are many varieties, and it is reasonably certain that any patient suffering from this disorder will, in the course of time, try them all. For habitual use cascara, senna, and rhubarb seem to be the most efficient of the vegetable forms. Sufficient doses must be employed to secure a satisfactory movement. It is essential to avoid purgation, and it is desirable to reduce the dose steadily if this is at all possible. Of the saline laxatives, the simplest is common salt, taken either dissolved in a glass of water before breakfast or in the form of some of the natural sodium chlorid waters. In a very small proportion of cases it is remarkably effective. In the majority it is useless. Of the natural saline waters, those which contain mixtures of magnesium sulphate appear to be the best. As in the use of other laxatives, the dose should be no larger than necessary to secure a satisfactory movement, and should, if possible, be steadily reduced. There appears to be little choice among the various laxative salts. Magnesium sulphate, given in the following manner, I have often found satisfactory. One or two teaspoonfuls are dissolved in the same quantity of water, as hot as it can be swallowed. This is taken at one draft, followed by about half a glass of cooled, not ice-cold water. It should be taken upon arising in the morning. Each day usually it is possible to reduce the dose slightly until the daily quantity of half a dram or even less is sufficient. It will usually serve for one or two months, and then it will be found necessary slowly to increase the dose, or preferably to discontinue the saline and resort for a time to a vegetable laxative. Phosphate of soda may be administered in the same way. Magnesium oxid and magnesium carbonate may be taken in powder form in doses of from 5 to 10 grains after each meal or 20 or 30 grains at bedtime. Wholly to be avoided are phenolphthalein, which, as Abel has shown, acts only upon the small intestines, and agar-agar, which is a mechanical laxative and acts chiefly by partially obstructing the bowel and therefore stimulating peristalsis. It can only do harm.* Of course, all the mercurial preparations are contraindicated as habitual laxatives.

Assuming that the obstruction is chiefly or wholly in the large bowel, it would seem that enemata should, of all laxative measures, act most directly and efficiently upon this part of the intestinal tract. The daily enema habit has gained little vogue in America, although in Europe it is not uncommon. Various substances that may be used are plain water, physiologic salt solution, soap and water, and various combinations which contain, as a rule, magnesium sulphate, glycerin, and water. In addition to these, the oil enema introduced by Kussmaul is of advantage, and in certain cases suppositories suffice. For daily use plain water is probably the most satisfactory. Fairly large quantities may be used,—from a pint to several quarts,—although it is undesirable to employ the latter amount as a single injection. If the smaller quantity suffices, it is usually preferable, although some authorities recommend a thorough washing of the colon for the purpose of avoiding intestinal auto-intoxication, and there seems to be little doubt that in some cases such obscure symptoms as headache and mental depression are relieved at least temporarily by this measure. Physiologic salt solution is equally efficient, but possibly not quite as stimulating to the bowel. There is no absolute certainty upon this point. The solution of a small amount of soap in the water appears to be innocuous and to promote the evacuation of feces. The so-called compound enema of glycerin, magnesium sulphate, and water is to be used only occasionally when there is severe constipation.

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* Mangelsdorf: Therapeutische Monatshefte, May, 1908.

Much was expected from the oil enema when it was first introduced, and it was supposed that at last we had at our command a method of overcoming habitual constipation, but subsequent experience has shown that the results are often temporary. From 8 ounces to a pint of oil should be employed. It should be warmed to a temperature of 100° to 105° F., introduced slowly, and retained as long as possible. Often the effect persists for several days, and therefore it is not necessary to employ the injections more than two or three times a week. There are no definite indications, but the oil is most useful if there is fecal impaction; if scybala occur in the bowel movements, or are found after an experimental injection of oil, and particularly if there is mucus. Indeed, the attacks of mucous enteritis which occasionally occur in coloptosis as well as in other conditions are most effectually treated with the oil injections, followed, if necessary, at an interval of some hours, by lavage of the colon with physiologic saline solution.

Of the suppositories, only the glycerin and glutoid suppositories need be considered. The former is fairly efficient, and some patients employ it frequently or even daily. It is apparently harmless and may be used without hesitation. The glutoid suppositories are too mild to be of much value, and are only to be used if they prove adequate.

There is considerable dispute as to the value of massage. Some authorities, including Boas, consider it injurious, and others* contend that it is of great value. The Swedish experts are in the habit of claiming that they can cure these forms of chronic constipation either by stimulating the peristaltic action or by actually in part replacing the intestines. My personal experience has been unsatisfactory, several of my patients having been in the hands of competent operators for considerable periods of time without any or only temporary benefit. It scarcely need be said that the various methods employed, chiefly by irregular practitioners, for the purpose of dilating the sphincters or applying electricity to the rectum are of no value.

Ptosis of the liver rarely gives rise to any symptoms unless obstruction of the bile-ducts occurs. To this reference has already been made. The treatment consists in putting the patient absolutely at rest and waiting until the attack subsides. There seems to be little advantage in any attempt to replace the liver. The repetition of the attacks may be prevented by suitable mechanical support.

Of the operations that have been devised to replace the liver little need be said. Perihepatitis may become a serious condition, and should not be produced artificially, and none of the other measures appear to be of the least efficiency.

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* Predescu: Abs. Archiv f. Verdauung., 1909, xv, 653.

Ptosis of the kidney is, as the statistics quoted in the early part of the article have shown, a very common condition. Indeed, Lennhoff believes that a palpable kidney is normal in certain types. A considerable number of obscure symptoms have been ascribed to it, particularly pain or a dragging sensation in the flanks. Actually the only definite symptom is the Dietl crisis. It may be recognized by swelling and tenderness of the affected kidney, intense local pain, possibly some fever, and hematuria. The treatment consists in keeping the patient at absolute rest flat upon the back until the symptoms subside. Gentle and cautious attempts may be made to push the kidney upward. Anodynes may be necessary to relieve the pain. The diet should be restricted and of the lightest character. Recurrence may be rendered unlikely by a well-fitting binder or corset, possibly reinforced by a pad, although I have never found this necessary. Regarding the various surgical measures that have been employed so extensively upon ptosed kidneys, particularly the various forms of nephrorrhaphy, I am wholly in accord with Stiller, who condemns them unqualifiedly unless there are distinct signs of local disturbance in the affected kidney. He calls attention to the frequency with which, after these operations, the symptoms of pain, weight, etc., still persist, or even are transferred to the opposite side, and I have observed the same thing in several cases. The operation never produces, in my experience, any distinct improvement in nutrition, and whatever effect it may have, I believe to be wholly psychic.

SURGICAL TREATMENT OF VISCEROPTOSIS

By John H. Gibbon, M.D.

No one knows better than the surgeon himself that operative treatment is not indicated in every case of visceral ptosis, or that in certain cases far better results are obtained by hygienic and mechanical treatment. As a rule, the best surgical results are obtained when a marked ptosis involves but one or two viscera, and the poorest results when a general enteroptosis is present. This can, no doubt, be explained on the ground that the condition in the latter cases is largely the result of faulty development, and no amount of surgery can correct the structural changes. On the other hand, when a single organ is displaced, such as the kidney, no such structural malformation is present, and the replacement and fixation of the ptosed viscus give a good result.

There can be little doubt that a few years ago too ready resort to operative measures in visceral ptosis was the practice of surgeons. Time and study have shown us that the symptoms which we supposed were due to a slightly movable kidney were, in reality, the result of a lesion in some neighboring organ, such as the appendix, gall-bladder, or stomach. It is an error to attribute to a slightly movable and easily palpable kidney, producing no distinct urinary symptoms, a whole line of nervous and gastric symptoms, and yet until recent years this was an error frequently made, and followed by the greater one of attempting to cure the patient by a nephropexy. Simply because a woman or a man has an easily palpable kidney we must not ascribe all the symptoms of which the patient may complain to this condition, even if we are unable to find their real cause. Another mistake we too often make is that of telling a nervous patient that the kidney is movable or displaced, for immediately his interest becomes focused on this point, and it becomes a difficult task to persuade him that operation is not indicated. Moreover, the internist should not recommend operation in these cases without first conferring with the surgeon, because if the latter should find that operation was not indicated, both are placed in an embarrassing position. The idea is entirely too prevalent among the laity, as well as the profession, that the surgeon should not be consulted until every one's mind is fully made up that operation is necessary. Any surgeon operating upon these cases of visceroptosis simply because the physician and the patient are tired of one another, and because "every medicine has been tried," is sure to do useless and harmful surgery and bring discredit upon himself and surgery. Each case should be carefully considered by both internist and surgeon, and treated as an individual case, because in no condition is it more difficult to lay down iron-clad rules of practice. There are already too many patients walking about with "fixed" kidneys, with "plicated" stomachs, and with resected or "side-tracked" colons, who are as miserable, or more so, than before their operations, and all because their case was one of general enteroptosis, or because the real lesion causing their symptoms has been overlooked. On the other hand, it must be said that many miserable and ill women have been restored to perfect health by a properly performed nephropexy, gastropexy, gastro-enterostomy, or colon resection. Our endeavor, therefore, should be to learn not only how to perform the steps of these operations with neatness and accuracy, but how to select the cases that really require operation and how to avoid those which will not only not be helped, but often made worse; and this selection, or rather this good surgical judgment, can only come by reading with an open mind what has been accomplished by the painstaking internist, neurologist, and orthopedist.

Those cases of general visceroptosis in which practically all the abdominal viscera are displaced, and which are, as a rule, the result of some congenital or acquired malformation of the skeleton, had best be treated by the means already outlined in the preceding sections; and the surgeon had better confine himself to those cases in which the symptoms can be definitely traced to one, or possibly two, markedly displaced organs.

Nephroptosis.—Having discovered that a kidney is "freely movable" or "floating," the surgeon's duty is not to apprise the patient at once of the fact, but to continue his investigation in order to discover whether or not its condition is responsible for the patient's symptoms; and unless distinct symptoms referable to the kidney are present, such as localized pain and tenderness, attacks of sharp pain simulating kidney colic, intermittent hematuria, and Dietl's crises, only the mechanical and medicinal treatment, already admirably outlined, should be advised. If, on the contrary, these definite renal symptoms are present and are not relieved by other forms of treatment, then the surgeon should consider the advisability of performing the operation of nephropexy. The most positive indication for operative interference is the repetition of the sharp attacks of pain due to kinking or compression of the ureter, accompanied by evidences of acute hydronephrosis, and suddenly relieved by the passage of large quantities of urine. It must be remembered in this connection that it is not always the most movable kidney which presents these symptoms, and, furthermore, that a few of these patients even are entirely relieved by the proper mechanical support. When the condition is complicated by a general visceroptosis, relief only of the urinary symptoms should be promised through operation. When the kidney is the only organ involved in the displacement, and when the distinct renal symptoms just mentioned are present, the results obtained from a properly performed nephropexy are most gratifying, converting a more or less confirmed invalid into a normal being capable of enjoying life. The failures, and worse than failures, come when the operation is performed in the absence of the indications just enumerated.

The operations which have been devised and practised for the fixation of the kidney are far too numerous to even mention in a work of this kind. The operations practised to-day are the result of a gradual evolution. At first, about 1881, the operation consisted in simply fixing the fatty capsule to the wound in the abdominal wall, and was followed, commonly, by a recurrence of the trouble. Next Reidel, Tuffier, and others advised the removal of the fatty capsule and the stripping of the true capsule. Later, sutures were passed through the kidney substance for the purpose of anchoring the organ, and, still later, Jaboulay, Senn, and others devised the plan of suspending the kidney in hammocks of iodoform gauze passed around each pole and allowed to remain for sufficient time to produce adhesions. This method is effectual, but painful and slow. Penrose improved upon it by passing rubber tubes around the kidney, which were easily removed and just as effectual as the gauze. Robert Morris and Edebohls then advised the operation of dissecting up a flap of the kidney capsule and fixing it between the edges of the split muscles. Harris, of Chicago, in performing nephropexy was the first to take into account the loose pocket of the peritoneum into which the kidney falls, and practises the obliteration of this pouch by carefully suturing to the posterior wall the two layers of the mesocolon which have become loosened from their normal attachments and permit the colon to descend far beyond its normal limits. This operation marked a distinct improvement over previous methods. The obliteration of the peritoneal pouch and the fixation of the colon are followed by one of the various operations for the fixation of the kidney itself.

As said before, the methods of performing nephropexy are too numerous to be detailed here, and I shall describe only my own practice in these cases, and lay down a few general principles.

The kidney is exposed, the greater part of the fatty capsule removed, and the suggestion of Harris then followed. My own custom is now to dissect up a flap of the kidney capsule, the two ends of which remain attached to the two poles of the kidney, and this flap is drawn out and the edges of the divided muscles closed under it. I have termed this the "flat-iron operation," as the flap when loosened stands out exactly as the handle of an ordinary flat-iron. It has recommended itself to me for the following reasons: It leaves an exposed area of kidney substance which must become adherent to the wound in the posterior abdominal wall; the wound is closed without drainage and the convalescence is short; the flap does not tend to tear away from the kidney; no sutures are passed through the kidney substance; and it would seem impossible for a kidney so anchored to again become loose. I first did this operation in November, 1905, and have used it with satisfaction in every case operated upon since then. The first patient, a woman whose left kidney descended into the iliac fossa and gave rise to frequent attacks of obstruction of the ureter, has ridden horseback regularly since her operation, the kidney remaining absolutely stationary and the patient free from all urinary symptoms. The accompanying illustration (Fig. 34) shows the style of the flap, which is the only original point in the operation.

In all operations for fixation of the kidney I believe it is important not to try to fix the kidney too high, not to pass sutures, even absorbable ones, through the kidney substance, to employ one of the methods of operation which allows immediate and complete closure of the wound, to obliterate the peritoneal pouch into which the kidney falls by sewing the colon to the posterior abdominal wall, and to free at least a part of the kidney of its capsule. It must be remembered that when other viscera are involved in the ptosis, a non-surgical form of treatment should be carried out after the kidney has been fixed by operation.

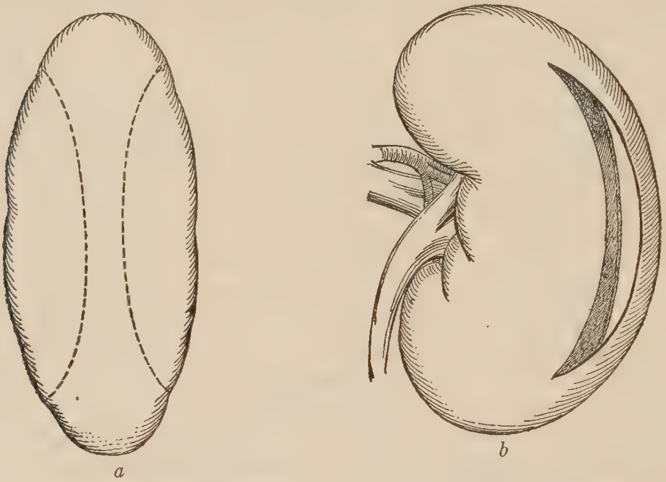

Fig. 34.—*a*, Posterior view of kidney, with outline of flap to lift up indicated by the dotted line; *b*, the flap dissected up and ready to be drawn up and fixed between the edges of the muscles.

Gastroptosis.—Next to nephroptosis, gastroptosis is the most common form of visceral displacement which may require surgical interference, but here again the same general rule already laid down for nephropexy must apply, namely, that operation is called for only when, because of its displacement, the stomach fails to perform its function, and this only after the mechanical, dietetic, and medicinal measures have failed. Much useless and harmful surgery has been done in this field, but we are now able, through experience, to select the cases which should be submitted to operation, and they are rarer than was at one time supposed. I think it may be definitely said that so long as the motility of the stomach is maintained, that is, that it is capable of emptying itself in a reasonable time, no operation should be done. The question of operation should be decided more by the degree of interference with function than by the degree of ptosis. The radiologists have shown us not only that the normal position of the stomach in the erect posture was not what it was formerly supposed to be, but also that even when it falls far below what may now be considered its normal position it may still perform its function in quite a satisfactory manner, emptying itself in a reasonable time. Except in injuries of bone and the location of foreign bodies the *x*-ray has been of more help in the diagnosis of lesions of the stomach and intestines than in any other of its various fields of usefulness. No operation for gastroptosis should be done until the location of the stomach in the erect posture and its ability to empty itself have been accurately determined by this excellent means. The information thus obtained is worth more to the surgeon than that gained by all the other methods. In this connection it should be said, for the benefit of those unaccustomed to interpret *x*-ray plates, that what may appear to them as a most unusual and distorted arrangement of gastric relations may, as a matter of fact, be quite within the category of normal. It is a mistake to confine our *x*-ray investigations simply to the location of the stomach, for it is even more important to know how long it takes the stomach to empty itself. It must appear evident to the most casual thinker that when gastroptosis is accompanied by a hepatoptosis and a general displacement of the other abdominal viscera, no amount of plastic work on the stomach or its attachments will permanently correct its malposition. The only warrant for operation in such a case would be the presence of definite gastric symptoms, due to the inability of the stomach, because of its position, to perform its function promptly. In such patients the stomach will be found dilated and hypertrophied, and the symptoms are practically those of pyloric obstruction. Under such circumstances I am convinced that surgery can accomplish a great deal, for I have operated upon a number of such patients with most satisfactory results, both from their point of view as well as from my own. The operation in these cases should be a posterior gastro-enterostomy, and nothing else, unless it be the occlusion of the pyloric orifice. I make this positive statement because I am satisfied that when all the viscera are more or less involved in the ptosis, any form of plastic operation performed on the stomach or on its elongated attachments will not hold for any length of time, and hence that it is far better to drain the stomach in the position where it is found, has been for years, and where, in all likelihood, it will remain as long as the patient lives.

When the stomach alone is involved in the displacement, or principally involved, one of the various forms of operation directed toward the correction of the displacement may be employed. Such operations are of two types—that which involves the shortening of the normal supports of the stomach, and that which aims to give new attachments to surrounding structures, such as the abdominal wall. The former operations are by far the most rational and have given the best results.

Duret, in 1896, first suggested and practised the operation of attaching the pylorus and lesser curvature of the stomach to the abdominal wall, in the hope of thus supporting it in its proper position (Fig. 35). This method has the strong objection of interfering with the normal movements of the stomach during digestion, and we all know the distressing symptoms which may be produced by gastric adhesions.

The operation of Rovsing (Fig. 36), although performed by him successfully in a number of cases, does not commend itself to me, for the reasons just mentioned in connection with the Duret operation. In this operation the anterior gastric wall is attached to the abdominal wall by silk sutures passed through the entire thickness of the abdominal wall and tied over a glass rod. This method of suture has the distinct objection of being crude.

Coffey, in 1902, recommended the restoration and support of the stomach by attaching the gastrocolic omentum to the abdominal wall. This operation to my mind has the objection of fixing the organ in such a manner as to interfere with its motility. This operation is a distinct improvement over that of the two just mentioned, and has been employed a number of times by American surgeons (Figs. 37 and 38).

In 1900 Bier advised an operation in which the pylorus and lesser curvature of the stomach were attached to the under surface of the liver. Eve has performed a similar operation a number of times, and apparently with success (Figs. 39 and 40).

Probably the best of all operations having for their object the restoration of the stomach to its normal position is that of Beyea, which was described in 1899. This operation, which is well illustrated in the accompanying cuts (Figs. 41 and 42), consists in reefing the gastrohepatic omentum by introducing three rows of interrupted sutures. This method has received support from surgeons everywhere, and I have employed it in several cases with satisfaction. It has the distinct advantage of interfering in the least possible way with the motility of the stomach.

Before leaving this subject I want to repeat that none of these operations is advisable when there is a general visceroptosis, and that under such circumstances, if the gastric symptoms warrant any operation on the stomach, a posterior gastro-enterostomy should be done.

Hepatoptosis.—This condition is seldom met with unless accompanied by a general visceroptosis, and, consequently, rarely calls for operative interference, such cases giving far better results from mechanical support combined with general hygienic treatment. The displacement of the liver, however, is a condition which was early recognized, and operations for its correction were devised and practised as early as 1890. The early operations, and there has been little improvement made in them, consisted in fixing the edge of the liver to the costal border by some method of suture. Later the plan of producing adhesions between the liver and diaphragm was added by Franke to that of suture, and was accomplished by gauze packing. The following brief statement of the essentials of the operation of hepatopexy is given by Moynihan: "To make an incision obliquely,

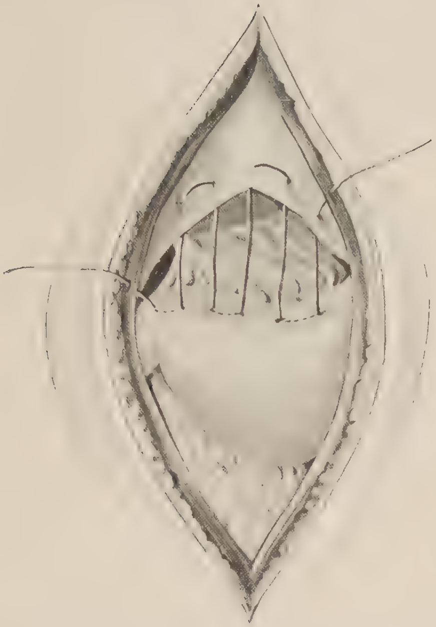

Fig. 35.—Gastropexy: Duret's operation (Moynihan).

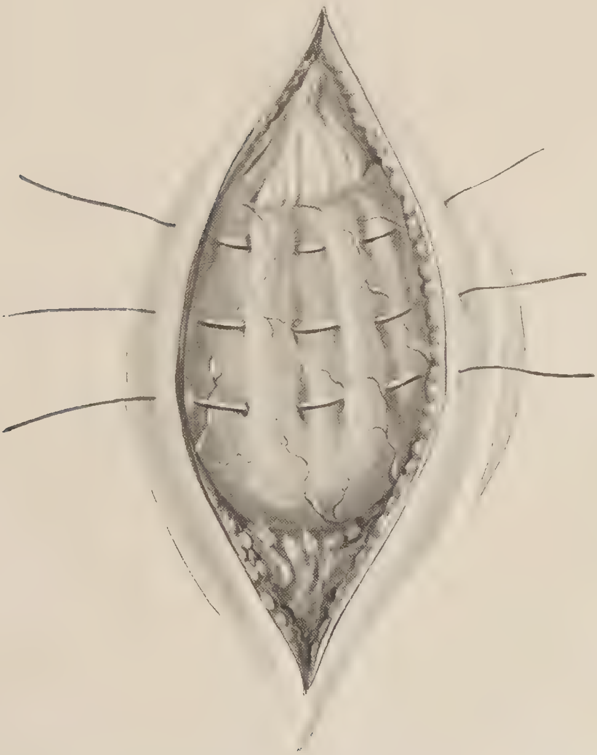

Fig. 36.—Gastropexy: Rovsing's operation. The area between the stitches is scarified with the intention of promoting firmer adhesions (Moynihan).

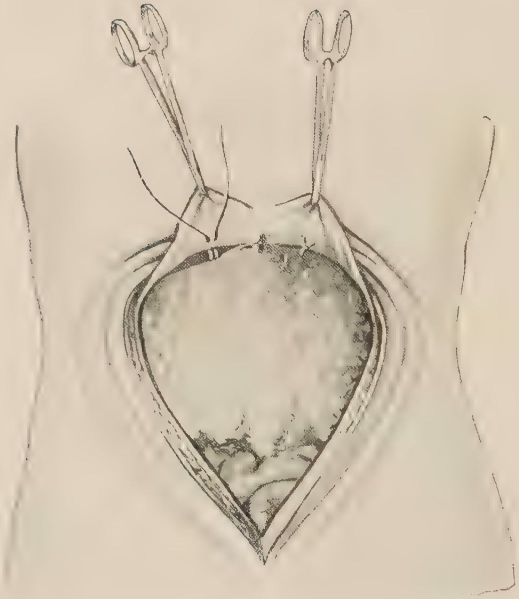

Fig. 37.—Gastropexy: Coffey's operation. The suture of the omentum to the anterior abdominal wall (Moynihan).

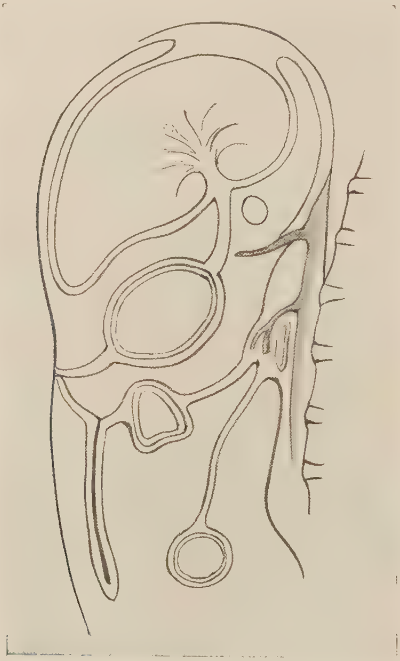

Fig. 38.—Gastropexy: Coffey's operation. The suture of the omentum to the anterior abdominal wall (Moynihan).

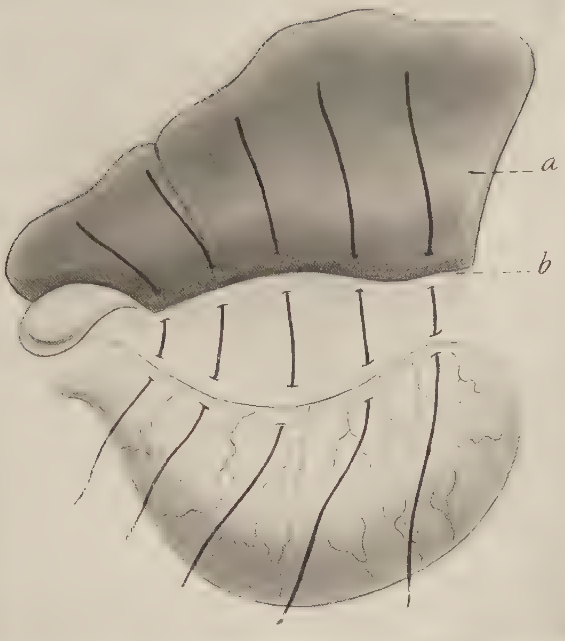

Fig. 39.—*a*, Liver; *b*, junction of gastrohepatic omentum with liver (Eve).

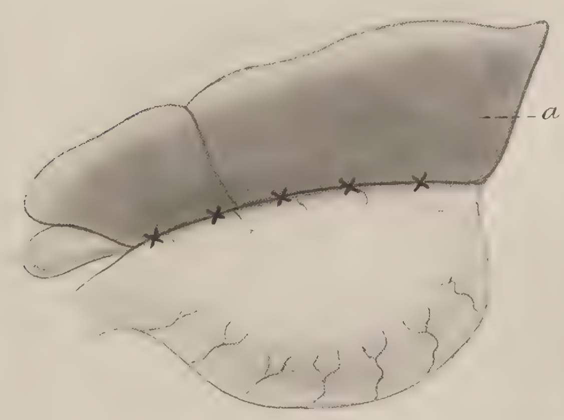

Fig. 40.—Liver turned up. Sutures shown in Fig. 39 now tied (Eve).

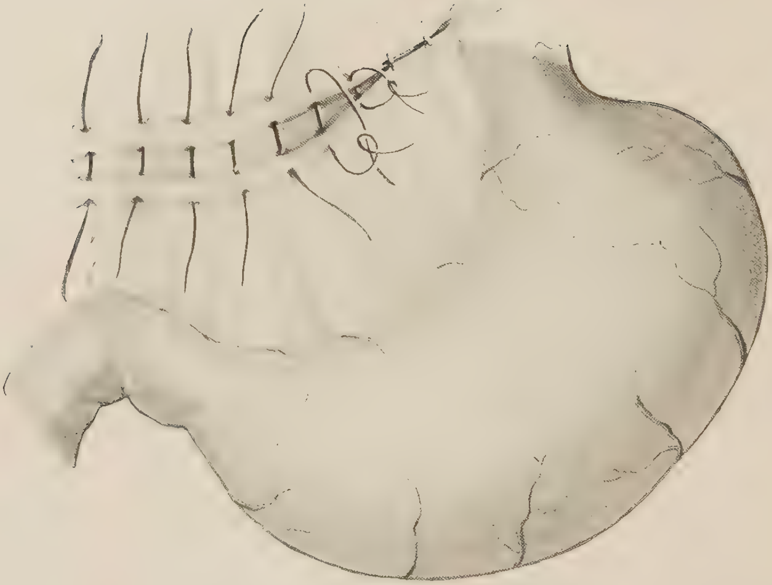

Fig. 41.—Beyea's operation for gastroptosis—the first layer of sutures (Moynihan).

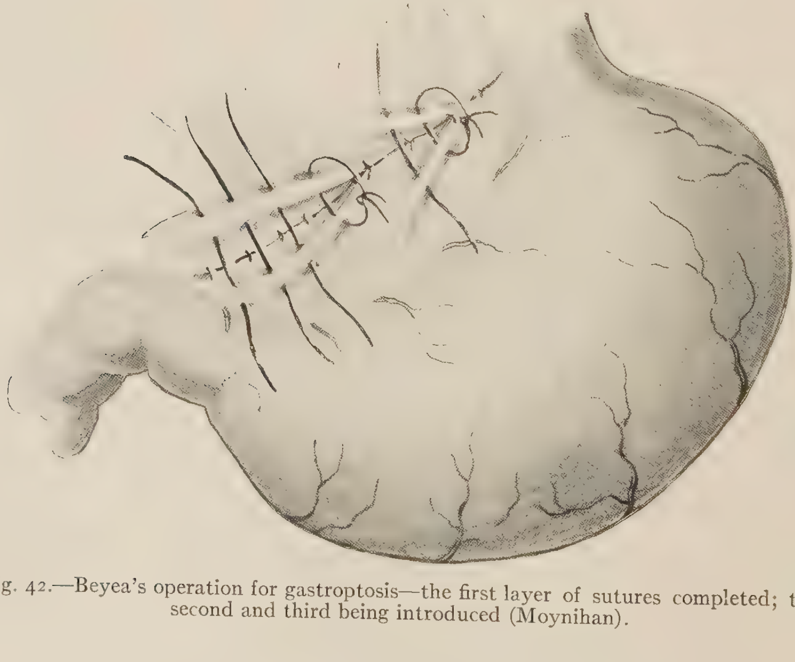

Fig. 42.—Beyea's operation for gastroptosis—the first layer of sutures completed; the second and third being introduced (Moynihan).

about one inch below the costal cartilages; to replace the liver; to fix the anterior edge securely with several sutures to the costal margin; to pack in between the liver and the diaphragm, and possibly also beneath the right lobe of the liver, many strips of gauze, which should be left in place a week; to keep the patient absolutely at rest in bed (with the foot of the bed elevated a few inches) for at least one month."

In certain of these patients symptoms indicative of gall-stones may present, or jaundice may develop rarely without other symptoms of stone, and here operation should be performed. The operation for the removal of the stones should invariably be combined with one to overcome the malposition of the liver. In many instances the gall-bladder may be satisfactorily employed as a suspensory ligament. Jonas, of Omaha, in 1902 reported a number of cases of prolapse of the liver successfully restored to normal position by fixing the gall-bladder to the costal border at the upper end of the abdominal wound. I can confirm his statement that it takes much less support to keep the liver in its proper position than one would suppose, and I have followed his suggestion of using the gall-bladder for this purpose on a number of occasions.

Ptosis of the Colon.—This condition has in recent years received a great deal of attention on the part of surgeons, so much, in fact, that it would seem that we were apt to wander as far astray in the selection of cases for operation as we formerly did in the case of the kidney. One of the difficulties at once presenting itself here is that of knowing what is the normal situation of the colon.

A careful study of the position of the colon in apparently normal people and *x*-ray plates made in similar cases have shown the greatest variety in what must be considered its normal position. By normal position I mean one that does not interfere with the proper performance of the bowel function. The degree of disturbance of function, as in the case of the stomach and the kidney, should be the criterion in determining the advisability of operative interference.

It is a mistake to attribute all the ills of malassimilation, malnutrition, and autointoxication to what is supposed to be a misplaced colon. Arbuthnot Lane has done more work on the colon, perhaps, than any other surgeon, and his results are apparently satisfactory; but in hands of others less skilled and less experienced than he in colon resections, or short-circuiting, the results have, in too many instances, not warranted the operation. I am convinced that we should go slow in this field where some have gone too fast, and that only those cases should be selected for operation in which there is not a general visceroptosis, and in which there can be no doubt, after careful *x*-ray plates have been made with the colon filled with a bismuth mixture, that the displacement of the colon is the cause of the patient's symptoms. Colon resection is a much more serious operation than any which has been mentioned in connection with other ptoses, and should not be undertaken lightly. I am sure that the too enthusiastic imitators of Lane will carry this operation too far, and not derive that satisfaction from it which he has. Furthermore, I cannot be persuaded that such degenerative changes as cystic disease of the breast, and such infections as tuberculosis of the hip-joint, can correctly be attributed to intestinal stasis resulting from a displaced or partially obstructed colon, or that the correction of such displacement and relief of the obstruction can cure, or even aid in the cure of, these conditions. Lane has done much to perfect the operations done on the large intestine, and deserves the thanks of his fellow-surgeons, but, like all pioneers, he is in danger of being outstripped by his followers, who have not devoted the same careful thought and study to the subject.

There are certain cases, undoubtedly, of marked displacement of the colon in which partial obstruction and marked distention and hypertrophy of the bowel occur, and these should be submitted to a proper resection or "side-tracking," and the operation, if properly performed, will give a satisfactory result. One should be most careful in the selection of the cases for operation and avoid those of general visceroptosis.

Splenoptosis.—The spleen may participate in a general ptosis of the abdominal viscera or it may be alone displaced. In the latter instance it is usually hypertrophied or has been displaced by injury. Although hypertrophy may produce the ptosis, so a continued displacement, by interference with the circulation of the organ, may, in its turn, cause hypertrophy. The simple participation of the spleen in the general visceroptosis is not sufficient warrant for operation unless the organ has become greatly hypertrophied or its pedicle twisted. In the case of a prolapsed or "wandering" spleen without other visceral displacement, operative interference is indicated, and should consist in the removal of the spleen or its replacement and fixation. Splenectomy is indicated in such cases only when the spleen is enormously hypertrophied, or when, from twisting of the pedicle, thrombosis of the vessels has occurred. The operation of splenopexy is a comparatively rare one, but has been performed a number of times in several different ways, and with success. Tuffier was one of the first to suggest and practise this operation. His method, which consisted in suturing the spleen directly to the abdominal wall, has not been followed generally, as it is often accompanied by considerable hemorrhage from the spleen. The operation of Rydygier commends itself to reason, and consists in the formation of a pocket made by dissecting up the peritoneum covering the diaphragm and inserting the spleen into this pocket. The incision in the peritoneum is made between the ninth and tenth ribs. The great advantage of this operation is that it obviates the passing of sutures through the spleen, which procedure is so apt to cause more or less hemorrhage. There are several other methods of performing this operation, but no one has been settled upon as being the best. A method that deserves mention, however, is that of surrounding the spleen in its replaced position by gauze packing, left in place for a sufficient time to produce adhesions, especially between the spleen and the diaphragm.

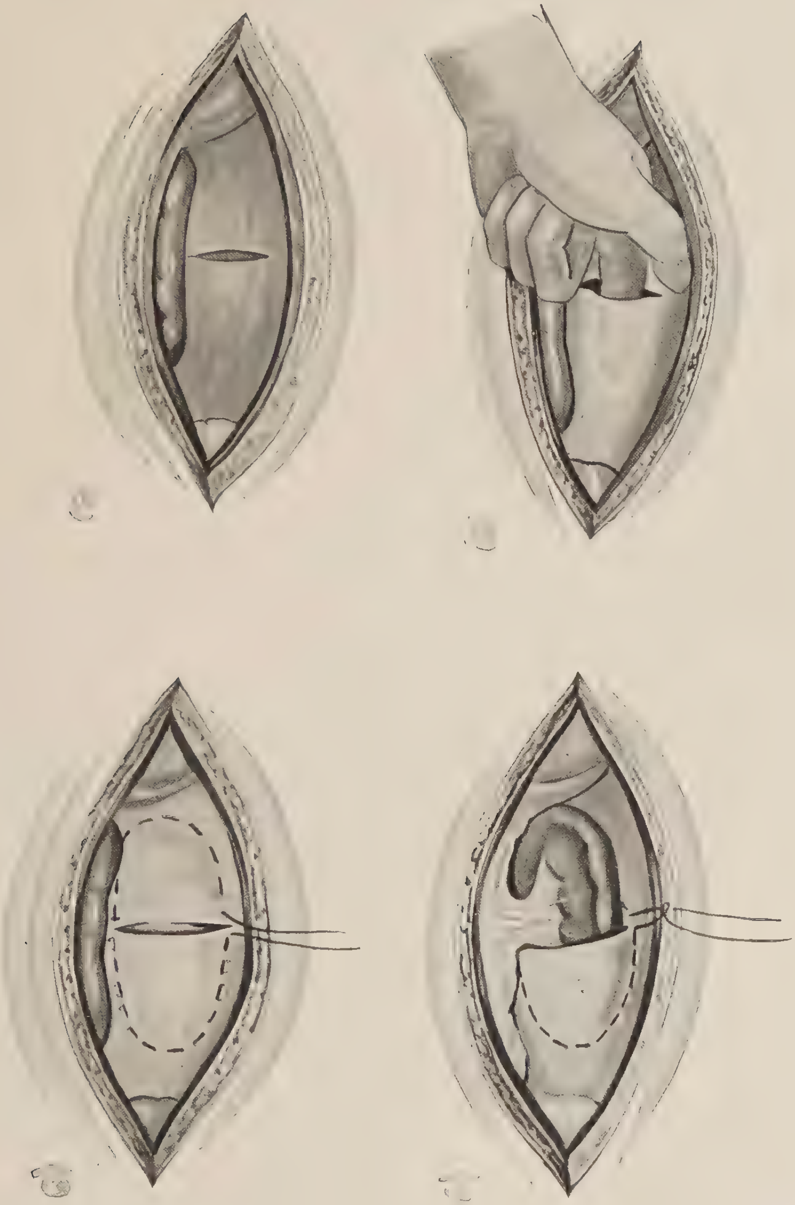

Fig. 43.—Splenopexy (Rydygier's method): Incision in the peritoneum on the under surface of the diaphragm, and the formation of pockets above and below by the stripping up of the peritoneum. The upper pocket is very difficult to fashion, owing to the strong adhesion of the peritoneum there to the diaphragm (Moynihan).

PERITONITIS

By John H. Jopson, M.D.

Inflammations of the peritoneum are of several types and arise from a variety of causes. They are variously classified as acute and chronic, aseptic and septic, idiopathic and secondary, local and diffuse, and, where due to a mono-infection of more or less characteristic type, as tuberculous, gonorrheal, and pneumococcus peritonitis. The various forms of peritonitis differ widely in their pathologic lesions and clinical course, as well as in the therapeutic indications, and it is necessary, therefore, in considering the latter, to adopt a classification that lends itself to a consideration of treatment. For this purpose we may describe them under the headings of acute and chronic peritonitis. The first group embraces aseptic and septic peritonitis. Chronic peritonitis may be exudative or plastic, and also includes tuberculous peritonitis. Such a classification, while open to certain objections, is an available one for discussing questions of treatment.

Acute Peritonitis

ASEPTIC PERITONITIS

In the great majority of cases acute peritonitis is a septic process, the result of bacterial invasion. In a comparatively small number of cases inflammatory processes, akin to the processes of repair, are present as the result of mechanical or chemical irritation. Such aseptic inflammation follows rough handling and sponging during abdominal operations, the use of such antiseptics as carbolic acid and bichlorid of mercury, the accidental inclusion of foreign bodies, such as instruments and sponges, the application of the cautery and of ligatures, and the introduction of drainage. It also follows such accidents as contusions, intraperitoneal hemorrhage, rupture of the gall-bladder or urinary bladder, and the early stages of intussusception, volvulus, and strangulation of the bowel, and twisting of the pedicle of an ovarian tumor. The pathologic changes are roughening, with redness and injection of the peritoneum, the deposit of fibrin, and the outpouring of a serous or hemorrhagic fluid. This stage is frequently followed by the formation of more or less extensive adhesions, and intestinal obstruction and strangulation may, in consequence, result.

Treatment.—Prophylaxis demands an avoidance of those errors of operative technic, such as rough handling, rough sponging, and other traumatic insults to the peritoneum, during operation. The use of strong chemical antiseptics during laparotomy has been abandoned, but the occasional operator still errs by using rough and injudicious manipulations. Care in the counting of instruments and abdominal pads minimizes the danger of leaving them in the abdomen. Tubular and gauze drains must be used with judgment, and gauze packs and drains are protected, when possible, by rubber tissue, to prevent their adhesion to the bowel. Gauze packs should not be roughly removed while they are still adherent.

When the peritonitis is dependent upon a foreign body, such as a pad or an instrument, the symptoms characteristic of such unfortunate condition will call for its removal, usually in the face of secondary complications. Aseptic peritonitis the result of intestinal intussusception, strangulation, and volvulus or twisting of an ovarian tumor is overshadowed in importance by the symptoms of the primary lesion, and subsides on its correction. In the later stages of such accidents migration of micro-organisms through the intestinal wall frequently gives rise to wide-spread septic inflammation of the peritoneum, which calls for the treatment appropriate to that dangerous malady. The same is true of aseptic peritonitis the result of hemorrhage and of biliary and urinary extravasation. In the stage of adhesions which follows the acute inflammatory process operation may be indicated where intestinal obstruction, complete or incomplete, or painful kinking or displacements ensue. Such adhesions not uncommonly reform after division. Deliberate production of aseptic peritonitis by scrubbing the upper surface of the liver with gauze to excite adhesions is practised as a therapeutic measure in hepatic cirrhosis, being one step in Talma's operation.

SEPTIC PERITONITIS

The vast majority of cases of acute peritonitis belong to this class. It arises as a result of infection of the peritoneum by micro-organisms, which may gain admission from the blood, as in some cases of pneumococcus peritonitis, or from the exterior, as in penetrating wounds or during the course of operation. In the majority of cases it is secondary to injury or disease of the abdominal or pelvic viscera. Idiopathic or primary peritonitis as a clinical entity has been discarded by all modern authors, it simply being a name to designate these cases in which the source of infection escapes detection. The common infecting organisms causing acute peritonitis are the colon bacillus, which is most frequently encountered, the streptococcus and staphylococcus, the gonococcus, and, more rarely, the pneumococcus, the Bacillus pyocyaneus, and the gas-forming bacillus. The infection is more often mixed than single. The resulting inflammation may be one of several types, and serous, fibrinous, seropurulent, hemorrhagic, purulent, and gangrenous peritonitis are described. Septic peritonitis is of varying degrees of virulence, according to the rapidity and extent of infection and the variety and strain of infecting organism. Injuries of the peritoneum, chemical irritation of the same, and the presence of foreign material, by decreasing the absorptive power of the peritoneum, favor the spread of infection. For therapeutic purposes septic peritonitis is best considered as diffuse and localized peritonitis.

Diffuse Peritonitis.—Much argument has been wasted in attempting to distinguish between diffuse and general peritonitis. Localized peritonitis is easily distinguishable, but when we come to separate the extensive, rapidly spreading inflammations of the peritoneum without limiting adhesions which come under the head of diffuse and general peritonitis, the question cannot be settled during the lifetime of the patient. It is now considered desirable to classify practically all these cases clinically under the heading of diffuse peritonitis, disregarding the question as to whether the extensive ramifications of the peritoneal lining of the abdomen are involved to an extent to entitle the process to be called a generalized one.

Diffuse or septic peritonitis is a highly dangerous infection, which, as we have seen, arises as a result of infection of intra-abdominal or extra-abdominal origin. It may be of traumatic origin, following wounds which penetrate the walls of the cavity, carrying infection or permitting its secondary entrance. Traumatism may also result in contusion or laceration of a viscus, permitting the passage of micro-organisms through its walls, in the first place, or the direct escape of infectious material in the second. It may follow operations, may arise from the bursting into the peritoneum of an abscess in an intra-abdominal or extra-abdominal organ, or by direct extension from such a process; or, as in the majority of cases, it may arise from the perforation of or migration of bacteria through the wall of some portion of the gastro-intestinal tract, or by extension from the Fallopian tubes, ovary, and uterus. Benda studied 446 cases of acute diffuse peritonitis, and of these the appendix was the source of infection in 115; the stomach and duodenum in 68; the rest of the intestine in 118; the female pelvic organs in 81, and the gall-bladder, and the kidney and urinary bladder in 10 each. So frequently is peritonitis dependent upon perforation of the gastro-intestinal tract that the term perforative peritonitis, coined to cover the condition and the cause, is in every-day use.

Treatment of Diffuse Peritonitis.—The natural progress of most cases of diffuse septic peritonitis is toward a lethal ending. In the earliest stages the symptoms which are present are usually those of the original lesion causing the peritonitis, plus those of beginning peritoneal irritation. We recognize a preperforative stage of peritonitis in which irritation and inflammation are confined to the peritoneal surface of an ulcer. In the later stages the symptoms of peritonitis obscure those of the local lesions, and oftentimes it is only by a careful study of the history of the case that a diagnosis of the cause can be arrived at. The ideal form of treatment combines correction or removal of the source of infection and treatment of the peritonitis. This can be accomplished only by surgical measures, which include removal of an inflamed or perforated appendix, suture of a perforated gastric, duodenal, or intestinal ulcer, and the drainage of an infected gall-bladder; in a word, the removal, as far as possible, of the exciting cause and the prevention of further infection. At the same time, through the same or an additional incision or incisions, the inflammatory exudate in the peritoneal cavity is allowed to escape, the process being aided by the proper introduction of drains of various kinds, and this escape sometimes assisted by sponging or irrigation at the time of operation. Postural methods, especially the so-called Fowler position, facilitate post-operative drainage. The after-treatment embraces those methods calculated to maintain the patient's strength, to overcome the toxemia which threatens life, to prevent the absorption and aid in the elimination of intraperitoneal and intestinal toxins, and to combat, as they arise, those complications, local and general, which not infrequently delay convalescence.

While surgeons are agreed upon the general principle of operative treatment of diffuse peritonitis, much difference of opinion still exists as to the proper time for operation when the disease has once reached an active stage. Immediate operation in the preperforative stage, whether for appendicitis, intestinal ulcer, or abscess, is, of course, indicated. In such cases operation is prophylactic as regards diffuse peritoneal infection. In some cases perforation and rapidly spreading peritonitis occur with little or no warning, as in certain gastric and intestinal ulcerations. In the early stages of diffuse peritonitis immediate operation is again usually indicated. The patient's condition is often good, cardiac and respiratory depression is not marked, delirium is absent, and vomiting is probably only of stomach-contents. Rigidity and tenderness may still be localized to the original infected area, although steadily spreading. Meteorism is absent or slightly developed. Operation within twelve or twenty-four hours of the onset of diffuse peritonitis, depending on the rapidity and virulence of the infection, yields far better results than when undertaken later. When this stage is passed, the condition of the patient is usually most precarious, and any form of treatment yields a much higher mortality. The mind is often clouded, and the temperature may be low or elevated, being an uncertain symptom in septic peritonitis. The respiration is shallow, the pulse rapid, and the face pinched. The abdomen is usually tense, distended, rigid, and tender, but sometimes flat or even scaphoid. Vomiting is frequent, the vomitus becoming bile-stained, later blackish from admixture of altered blood, and sometimes fecal in odor. Food and water are quickly rejected. The bowels are usually confined, and the urine scanty. Auscultation over the abdomen reveals absence of peristaltic gurgling. The leukocytic count during this stage is often low.

There is still a difference of opinion as to the advisability of immediate intervention in this stage.

Operation is attended with a high mortality, although this has been greatly reduced by the methods introduced and popularized by Murphy, which will be first described. These include a rapid operation, with removal of the cause of the peritonitis, if possible; a minimum of disturbance of the abdominal viscera; the introduction of

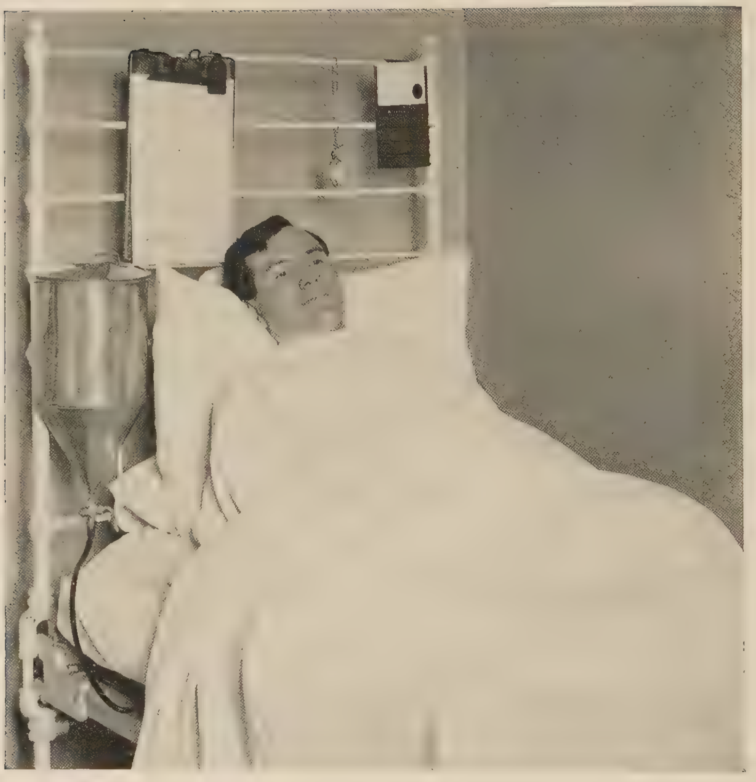

Fig. 44.—The Fowler position and the method of giving salt solution slowly by rectum in cases of peritonitis, etc. Note the slight elevation of the reservoir (Keen's Surgery).

tubular drainage into the pelvis through the wound, or through a second stab-wound above the pubis; the retention of the patient after the operation in the Fowler position, and the continuous instillation into the rectum of saline solution for several days, or until the severe inflammatory process has subsided (Fig. 44). Food and water are withheld from the stomach, which is washed out as frequently as is necessary to prevent vomiting and free it from regurgitated intestinal fluids. No irrigation is used during or after operation, and sponging is avoided at the time of operation. Large quantities of saline solution are absorbed by the lower bowel if proctoclysis is carried on by the method which will be described. Thirst is relieved, the urine increased in quantity, and the drainage from the wound is often profuse. It is claimed that there is an actual reversal of the lymphatic flow into the peritoneum. Excellent results are obtained by this method in the hands of its illustrious originator and the many American surgeons who have adopted it.

The so-called Ochsner plan of treatment, or the "starvation" method, as it is sometimes called, has its proper field in the treatment of diffuse peritonitis after the initial stage, and we believe, with Ochsner and Deaver, that in cases seen after it has fully developed, a judicious use of this plan of treatment, in cases of diffuse peritonitis, will be productive of a lower mortality than is secured by immediate operation. It must not be looked upon as a cure for appendicitis, or as an excuse for delay in placing the patient in the hands of the surgeon. It is as a preliminary to operative treatment that it is to be considered, such operation to be done when the process has localized itself and the patient's general condition is such that operation can be carried through with safety.

The method is carried out by placing the patient in the sitting or Fowler position, in order that peritoneal exudates may gravitate to the pelvis, where absorption is slowest and subsequent drainage most effectual. No measures must be taken to excite peristalsis, which hinders localization of infection. The ingestion of food and water is prohibited. Purgation is absolutely forbidden. An ice-bag or large warm poultices are applied to the abdomen to control pain. Morphin is contraindicated before operation is decided upon, as it increases distention, masks symptoms, and lends a false sense of security to patient and surgeon. The stomach is washed out to relieve vomiting, and the lavage repeated as often as is necessary. If it is desired evacuate the large bowel, only small enemata may be used. In addition to these measures constant proctoclysis, given according to the method of Murphy, is carried out as a most essential feature of the treatment. The body fluids are renewed by the rapid absorption of saline solution from the colon; the kidneys are kept active, and the toxins in the circulation and the peritoneum are diluted, and their excretion favored. The physiologic rest of the bowel favors the encapsulation of the peritoneal exudate, and thus aids in the efforts of the peritoneum to overcome and localize the infection. Under such a plan of treatment we expect to see the temperature gradually decline, the pulse become slower and fuller, the respiration return to a normal character, meteorism subside, and vomiting be checked. Peristalsis, normal in character, gradually returns, a rise in the leukocytic curve takes place, and finally a mass forms around the site of infection or in the pelvis. Operation, with its attendant anesthesia, can then be carried out, the abscess drained, and the source of infection removed.

A careful selection of cases is necessary before this treatment is decided upon. It would be manifestly unwise to adopt it in a perforation of the stomach or bowel, with a free and continuous escape of gastric or intestinal contents, or in a case of ileus or twisted ovarian cyst, for example, in which an error of diagnosis might be responsible for the loss of valuable time. Therein lies a source of error which must be considered, and which is one of the weak points in the argument for its more general use. The reduction in mortality by this method is especially striking in cases of perforating appendicitis seen at a late stage, in which it has proved most useful in our hands, and in cases of pelvic peritonitis arising from pus-tubes, where its usefulness is generally acknowledged; in pneumococcic peritonitis also this preparatory treatment will greatly aid in reducing the mortality, as Rutherford Morrison has recently emphasized. In 74 cases of diffuse peritonitis following appendicitis in Deaver's service, treated by this method, there were 6 deaths, or 8.1 per cent.

A third method of treatment which may be mentioned here is along the lines of prompt operation, with more radical attempts to remove primarily the source of infection and the products of inflammation, dispensing altogether in some cases with drainage of the peritoneum. Blake has advocated this plan of treatment and has coupled with appendectomy, for example, thorough irrigation of the peritoneal cavity and closure of the peritoneum, these measures being followed by gastric lavage, and the Murphy-Fowler plan of after-treatment as regards posture and enteroclysis. Such measures are frequently successful, but err, it seems to us, on the side of attempting the ideal, rather than in aiding nature by a minimum of operative interference, while conserving the natural resistance of the patient.

The proper method of administration of salines by continuous proctoclysis is of the greatest importance. As originally recommended by Murphy, it was very simple. A fountain syringe or can, with a rubber tube attached, which terminates in a vaginal hard-rubber or glass tip, flexed at an obtuse angle two inches from its tip, and having several openings in its bulbous end, are all that is necessary. The nozzle or tip should always be provided with several lateral openings, so that if one or two openings become plugged with feces, expulsion of gas will still be possible. The tip is inserted into the rectum, the angle fitting against the sphincter, and the tube is fastened to the thigh with adhesive plaster. The bag or can is suspended so that its base is from 6 to 14 inches above the level of the buttocks. Murphy uses a solution consisting of one dram each of sodium chlorid and calcium chlorid to the pint of water, and the solution is kept at a temperature of 100° F. by the use of hot-water bags, thermolytes, etc. The solution must flow in slowly, to prevent contraction of the rectum and frequent expulsion of the fluid. One and one-half pints an hour is the average rate of flow, and 18 pints or over can be given in twenty-four hours. No clamping or constriction of the tube to regulate the rate of flow is to be used.

Numerous modifications of this simple apparatus, which is invaluable in many types of septic infection, have been introduced, and a number of more or less complicated pieces of apparatus have been devised, most of them objectionable or cumbersome. Percival Nicholson has described a simple one which we have used with satisfaction in the Presbyterian and Polyclinic hospitals. A glass cylinder, or the barrel of a four-ounce glass syringe, is interposed three inches below the bag, and is fitted with a hard-rubber cork with two openings; in one of these the tube from the bag is inserted by means of a pipet which is fastened in it; the other opening in the cork acts as an air-vent. A pinch-cock above the cylinder regulates the flow, and the lower end of the cylinder is attached to a rubber tube, which in turn connects with one of the special hard-rubber proctoclysis nozzles which are now supplied by instrument-makers. The clip regulates the flow, which goes drop by drop into the cylinder, and thence through the tube. Hot-water bags are used to maintain the temperature of the water in the tube, being laid over and under it.

The technic of operation has been briefly described. It remains to emphasize the importance of rapidity of operation when done in the acute stage, the avoidance of rough manipulation and traumatizing of the peritoneum, or the disturbance of protective fibrinous exudates. The original focus of infection should receive attention if this can be accomplished without dangerous prolongation of operation or soiling of uninvolved peritoneal surfaces. Irrigation should be restricted to cases where the peritoneum is flooded with infective material, such as is observed in cases of large gastric and intestinal perforations, when we observe that it rapidly and gently removes much obnoxious foreign matter and peritoneal exudates. Evisceration and sponging and wiping of the intestines is harmful. Multiple counteropenings are not of much value, and a stab-wound above the pubes for a tube, in addition to the original operative wound, is all that is usually indicated. Tubular drainage, either in the shape of one or more large rubber or glass tubes, is carried down to the bottom of the pelvis, and perhaps into the renal pouch. Vaginal drainage, by inserting a tube through an incision behind the cervix into the culde-sac, is sometimes advantageous, especially in cases of pelvic peritonitis arising in connection with infections of the Fallopian tubes. The wounds are not sutured. Extensive gauze packing is undesirable. The anesthetic must be administered with great care. Puncture of distended bowel, enterotomy, and enterostomy, to drain the paralyzed bowel, are sometimes practised. They must be used cautiously, and are not generally applicable. If enterotomy is done, a glass tube should be passed for some distance into the bowel, to assist in emptying it.

Whichever of these two methods of treatment is employed, whether immediate operation or a preparatory course of treatment, as described, the treatment after operation is the same. A continuance of the Fowler position, the continuous enteroclysis, the withholding of food and water by the mouth until the peritonitis has subsided, lavage of the stomach for vomiting, and the avoidance of purgation are the most essential points to be emphasized. Morphin is withheld if possible. A small dose can be administered once, but large or repeated doses favor distention and intestinal paresis. Strychnin and adrenalin are useful to combat shock, and subcutaneous saline infusions may be useful adjuncts to the proctoclysis.

If the peritonitis is slow in subsiding, or if vomiting continues as a troublesome symptom, provision must be made for feeding in some form. This is best done by the use of nutrient enemata composed of peptonized milk, malted milk, or a combination of one egg and equal parts of milk and salt solution, to which may be added a little brandy. The rectum is washed out before the warm enema is administered, 6 ounces being the average amount of the latter which will be retained and absorbed.

Secondary operations to drain collections of pus are not infrequently called for. Of these, pelvic collections are the most frequent. Subphrenic abscess, with its characteristic symptoms, is now recognized as a not infrequent complication, but is often overlooked, and usually terminates fatally if not drained. It may rupture into the pleura and lung, or, as we have seen, drain itself by a long and tortuous sinus through the wound of operation. Persistent elevation of temperature and the physical signs over the base of the chest posteriorly are its most striking phenomena.

Ileus may present as a serious complication, and may be adynamic or mechanical. The first is best remedied by gastric lavage if vomiting is present, the use of eserin hypodermically, turning the patient on the right side, which favors the passage of flatus, and the use of high medicated enemata. Mechanical ileus calls for operation and liberation of the obstructed bowel. Fecal fistula, phlebitis, pylephlebitis, retroperitoneal lymphangitis, and embolic abscesses are among the numerous complications that may be mentioned.

Local Peritonitis.—Local inflammations of the peritoneum of an acute septic type arise from the same causes in most instances as does diffuse peritonitis. The inflammation of the peritoneum may remain confined to the neighborhood in which it arises by reason of active peritoneal resistance, or because the bacterial invasion is slow or lacking in virulence, or from a combination of these factors. A diffuse peritonitis may localize itself either as a result of treatment or spontaneously, in the face of the normal peritoneal resistance to bacterial invasion.

Examples of all these types of local peritonitis are encountered with great frequency. One finds, on opening the abdomen, evidences of local peritonitis in the presence of recent adhesions, and plastic exudates, or serous collections, illustrating respectively fibrinous or serous peritonitis of a localized character. Suppurative peritonitis, when localized, presents itself as an abscess, the walls of which are formed partly by plastic exudate, partly by the agglutinated abdominal viscera, including the coils of the intestine, the stomach, the liver, the Fallopian tubes, the mesentery and omentum, the parietal peritoneum, etc. There are often several pockets, and these may communicate or be entirely separate and some distance removed from each other, especially when the process follows the subsidence of a diffuse peritonitis, or when the original lesion is in the middle or upper portion of the abdomen, and secondary collections have formed in the pelvis as the result of gravity. Suppurating foci may form in distant parts by the spread of infection by continuity, or by extension from retroperitoneal cellulitis and septic lymphangitis. The bacterial content of the pus in the abscess may still be virulent, may be attenuated, or may have died out, as in many cases of old pelvic abscess arising from the Fallopian tubes. In any event, the local and general powers of resistance are greater than in cases operated upon for diffuse peritonitis.

Treatment.—The indications for treatment in localized septic peritonitis are generally clean cut and easily defined. The situation is usually less acute and threatening than is the case with diffuse peritonitis, but it has its dangers. Fibrinous exudates and small serous collections will not, as a rule, call for surgical intervention. Persistent adhesions may give rise to pain and intestinal obstruction or strangulation long afterward. Pus within the abdominal cavity calls for early evacuation, and we combine with this a correction or removal of the original focus of infection when possible. Such purulent collections, if undisturbed, are at times partially absorbed, and a small cheesy mass remains in the center of an area of well-developed adhesions. All symptoms may subside, but we have seen practical obliteration by adhesions of the lower portion of the peritoneal sac, with well-marked chronic obstruction and extreme emaciation and exhaustion in such a case. The abscess may gradually increase in size and reach great proportions. Pus may ulcerate into the bowel, or may discharge through the vagina or into the bladder; it may travel upward, behind, or in front of the parietal peritoneum, and form collections beneath the diaphragm, or rupture into the pleura and lung, or open into the pericardium. Septic pylephlebitis may complicate an abscess, and obstruction of the intestine develop in its wall. The localization of a peritonitis is indicated by a rigidity and tenderness confined more or less to the abdominal wall over that area, and the development of a mass, which may be prominent or but poorly defined. Extreme tenderness over such a mass is usually indicative of pus. The temperature may be continuously elevated, may be irregular, of a hectic type, or practically normal. Hyperleukocytosis is usually present. The constitutional condition may be but slightly affected, but symptoms of profound sepsis may be noted in the later stages. Vomiting is present early, but this subsides, and the bowels can be moved by laxatives or enema if mechanical obstruction is not present. As a rule, the patient's condition, as indicated by expression, pulse, and respiration, is far different from that of a case of diffuse peritonitis.

The treatment of abscess is by operation. Except in appendiceal abscess, which is the most frequent form encountered, the incision is usually made over the mass, if one be present. When the parietal peritoneum is adherent to, or forms part of, the abscess wall, it must be carefully incised, to prevent injury to the intestine. If we find on opening the parietal peritoneum that it is free from the surface of the abscess, and the general peritoneal cavity is thereby exposed, this must be protected from contamination by carefully walling off the infected area by moist pads or rolls of gauze before drainage of the abscess. A small opening is made by finger dissection between the planes of tissue into the abscess cavity, and the pus rapidly mopped up as it escapes, until the cavity has been drained. In operating for an appendiceal abscess we believe, with Murphy, that the incision should be placed to the median side of the abscess rather than directly over it, and the general peritoneal cavity first opened, to permit of freer exploration of the extent of the abscess and more effectual drainage and treatment of the same.

Pelvic abscesses are sometimes drained through the vagina by an opening behind the cervix. In the parietal abscesses lumbar drainage is sometimes employed. Removal of the source of infection is usually indicated, but no hard-and-fast rules can be laid down, except that we must not endanger the patient by attempts at a complete operation. If the abscess is thoroughly drained, the most imperative indications are thereby met. In the case of the appendix we believe that in the large majority of cases its careful and deliberate removal is, in experienced hands, the wisest course, and that a more speedy and complete convalescence is thereby obtained. It is usually advised that an appendix forming part of the wall of an abscess shall not be disturbed; but secondary pockets are frequently present behind it, and collections of pus are often encountered and drained, when the appendix is sought for and freed, that would otherwise escape detection. When it is not to be found on careful examination of its usual site, or when sloughed off at the base and deeply embedded, or when it is a case of very large abscess, it may safely be left. In any case the greatest care is necessary, and good judgment must be used in practising or attempting removal of the appendix in abscess cases.

Drainage of the abscess cavity is best maintained by rubber tubes of large caliber inserted to the bottom of the cavity, and surrounded, if necessary, by additional drainage in the form of gauze wicks. No irrigation is to be used. Counteropenings in the loin space are sometimes indicated. If the general peritoneal cavity is contaminated during the operation, a drainage-tube is left in the pelvis, which should always be examined for secondary collections when the general peritoneum has been opened. It is safer to use a limited amount of gauze packing to keep the surrounding intestine from the opening in the abscess, and not to attempt to close the abdominal wall around the drains. The special technic of operation in subphrenic abscess and other forms of localized peritonitis varies with the position of the abscess.

CHRONIC PERITONITIS

Chronic inflammations of the peritoneum are secondary to acute inflammations, or develop without a history of preceding acute infection. They are probably never primary or idiopathic, but the source of infection is often difficult to detect. Clinically, they are classified as exudative peritonitis and plastic or adhesive peritonitis. The exudative type is commonly associated with the presence of adhesions, but the pure adhesive type frequently exists alone.

CHRONIC EXUDATIVE PERITONITIS

In the large majority of cases this is but one form of tuberculous peritonitis in which the peritoneal effusion is the most prominent symptom. In the non-tuberculous form the etiology is obscure. It is most frequently observed in young females, and is characterized by the gradual distention of the abdomen by serous fluid and by anemia, loss of weight, and sometimes pain and fever. Palpable tumors may be present. It is with difficulty diagnosed from tuberculous peritonitis, but the prognosis is better than in that affection. The treatment is hygienic in the early stages, and hydrotherapy and mercurial inunctions have been exploited and found useful in bringing about a cure. Tapping may be necessary to relieve pressure upon the abdominal viscera, and guinea-pigs may be injected with the fluid to determine the presence of tubercle bacilli. Laparotomy should be done if the case does not respond to medical treatment, and is recommended, both as a diagnostic measure, when tuberculous peritonitis or some of the other forms of ascites cannot be excluded, and as a means of cure, being efficacious in simple, as it often is in tuberculous, peritonitis. The pelvic organs should be carefully examined, as the frequency of occurrence in young women suggests that the disease may arise from the Fallopian tubes.

CHRONIC ADHESIVE OR PLASTIC PERITONITIS

The presence of adhesions and cicatricial contractures in the peritoneal cavity may be, and often is, secondary to acute inflammatory processes, and such adhesions are more persistent when the source of inflammation remains undisturbed. Recurrent subacute and chronic inflammatory processes are attended by the formation of equally well-marked or even more resistant adhesions; such are the sources of the recent and old adhesions we find around a diseased gall-bladder, appendix, or Fallopian tube. The origin of this form of chronic peritonitis is sufficiently clear. In other cases the adhesions have been especially noted in the neighborhood of the cecum, and such points of physiologic narrowing as the hepatic, the sigmoid, and especially the splenic flexures. The root of the mesentery and the omentum are also the seats of inflammatory thickenings and contraction. In these cases, while it cannot always be definitely proved, it is contended by Gerster and others that the source of infection is from the intestine, and that a colitis, secondary to chronic constipation, or, as Gerster has recently put it, "an undue developmental accentuation of the physiologic apparatus, serving to retard fecal transportation," is the exciting cause.

Treatment.—Adhesions of the most extensive character often melt away within a few months after the drainage of an abdominal abscess. This is very frequently observed after appendiceal abscess when the abdomen is subsequently opened for any purpose. A too hasty operation for the relief of adhesions may be unnecessary and harmful. Where chronic peritonitis exists as the result of an infected gall-bladder or a chronically inflamed appendix or Fallopian tube, removal of the source of infection is the surest means of cure. In those interesting cases of perityphlitis and pericolitis referred to above, which are characterized by the formation of adhesions, sometimes of a cobweb consistence and sometimes strong and resisting, and in which the patient suffers from colicky pain and obstinate constipation, laparotomy is sometimes necessary if the attacks are frequent and disabling. The kinked and stenosed gut is liberated by separation, division, or complete resection of the adhesions and bands which surround and constrict it. In not a few of these patients do we find the appendix has already been removed without avail. It is reasonable to insist that the operation should be followed by the adoption of hygienic and dietetic measures to cure the constipation and chronic colitis which are apparently predisposing factors. The heroic measure of removal of large portions of the colon, as recommended in certain cases by Lane, may be mentioned in this connection.

Unfortunately, there remains a group of cases of chronic adhesive peritonitis that are difficult of explanation. The adhesive process persists in spite of operation, and adhesions reform, even after repeated operations and the use of such measures as peritonization of raw surfaces, omental grafting, and the various measures to which surgeons have resorted.

TUBERCULOUS PERITONITIS

The treatment of this disease has been already considered (Vol. II). To recapitulate, it may be mentioned that, aside from the acute miliary form, it is encountered as the serous, or exudative, the dry fibrinous, and the ulcerative types of infection. It is rarely if ever primary, and may arise by direct extension from the intestine or other abdominal viscus, or the tubercle bacilli may be carried by the blood-

or lymph-streams. It is commonest in children and young adults between the ages of twenty and forty. A considerable number of cases respond to hygienic and medicinal treatment (*loc. cit.*). Such treatment should be tried in most instances before resorting to operation. The dry cases, fibrinous and ulcerative, are not favorable ones for treatment by laparotomy in most cases; especially is this true if the peritoneal cavity is largely obliterated by agglutination and adhesion of the intestinal and parietal peritoneum. Attempts at liberation of such adhesions are followed by hemorrhage, injury of the friable intestinal wall, and the development of fecal fistulas, which constitute a very unfavorable complication. The serous, or "wet," cases, on the other hand, furnish a considerable percentage of cures (40 to 50 per cent. in Czerny's clinic). If a trial of medical treatment, continued over several weeks, is not attended by improvement, or if effusion and abdominal distention increase, laparotomy is indicated, combined with the evacuation of exudate, aided by sponging, and followed by closure of the wound without drainage. Many surgeons irrigate with salt solution; others dust the peritoneum with iodoform; still others use iodin solution or inject oxygen gas. The benefit derived from these latter measures is questionable. If a primary tuberculous focus can be removed,—and such may be present in the appendix, the cecum, or the Fallopian tubes,—this should be done. Single tuberculous lymphatic glands can sometimes be shelled out without endangering the blood-supply of the intestine. After operation the patient should again be placed under the most favorable hygienic surroundings, including open air, sunshine, feeding, and every possible measure to aid in overcoming the tuberculous infection. We have combined with such hygienic measures the use of tuberculin, with apparent benefit. The manner in which simple laparotomy cures tuberculous peritonitis is unknown. Relief of intra-abdominal tension, exciting of peritoneal hyperemia and increased leukocytic activity, the formation of opsonins and endothelial degeneration, are among the explanations suggested. While we cannot state how operation benefits, long experience has proved that in some cases the cure is apparently a permanent one, and the patient returns to active life and usefulness. In other cases the improvement may be partial or temporary, and reoperation is sometimes indicated if recurrence is observed.

THE URINARY SYSTEM

DISEASES OF THE URINARY SYSTEM

By Egbert Le Fevre, M.D.

HEMATURIA

Hematuria, or presence in the urine of red blood-corpuscles, may be due to local lesions in the genital tract, with overdistention or rupture of blood-vessels. The source may be from the tubules of the kidney, pelvis of the kidney, ureters, bladder, prostate, or urethra, and it may be caused by inflammation, the presence of cancer, tubercular or syphilitic disease, or parasites. The conditions which may produce acute congestion of the kidneys are sometimes so intense as to cause blood-cells and albumin to appear in the urine.

Symptomatic hematuria may occur in the course of general diseases which affect the blood and blood-vessels, as purpura, hemophilia, scurvy, malaria, etc.

Vicarious hematuria may appear as the result of menstruation, etc.

The treatment of hematuria will be governed by its cause. As it is rarely a primary disease, the diagnosis and treatment of the primary condition are most important. For the hematuria itself, rest in bed, protection of the body against chills, restriction of the diet, and rendering the urine as non-irritating as possible are the chief indications. Although innumerable drugs have been recommended for the purpose of controlling the hemorrhage through their action upon the blood and blood-vessels, but little can be accomplished by their use. The use of ergot to constrict the blood-vessels has proved valuable in certain conditions, but cannot be relied upon. Where the occurrence of blood in the urine is associated with cardiac overaction and high blood-tension, the use of cardiac sedatives, such as aconite, is indicated. In these cases all causes that induce cardiac irritability should be avoided.

Hematuria that comes from overexertion, such as bicycle-riding, athletic sports, etc., should be avoided by limiting the amount of exercise taken. It is especially apt to occur in young males during adolescence, and is closely associated with albuminuria at the same age.

When the source of the hemorrhage is in the lower genito-urinary tract, as bladder, prostate, or urethra, the local application of astringents may be beneficial. The introduction of the cystoscope permits of definite diagnosis and application to the bleeding spot. When the hemorrhage is extreme, or so persistent as to endanger life, surgical treatment is necessary.

When the hemorrhage has been so free that clots are formed in the bladder, they should be broken up by instruments, and the bladder thoroughly washed out. The use of pepsin and peptonizing solutions has been recommended for this purpose, but there is danger of setting up irritation in the bladder, and also of inducing rapid decomposition and infection. The presence of blood in the bladder renders it necessary to avoid all danger of infection of the bladder by the use of instruments, and also to prevent the retention and decomposition of the urine in the genito-urinary tract. The greatest antiseptic precautions must be used in examining the bladder by the cystoscope, or in catheterization for the removal of the urine and clots. Unless there is some definite reason for using instruments, such as retention, decomposition, etc., they should not be introduced merely for the sake of washing out the bladder. The same rule should govern the use of the catheter as that described under Acute Cystitis.

PYURIA

In pyuria pus-cells may be present in the urine as the result: (1) Of inflammatory conditions of the genito-urinary tract, as in acute suppurative nephritis, pyelitis, cystitis, urethritis; (2) of an extension of inflammation to the genito-urinary tract from contiguous or remote parts, of abscesses, etc.; (3) of accidental contamination, as from the vagina, etc.

As pus in the urine is merely symptomatic, the treatment will be that of the condition which causes it.

If the condition cannot be accurately determined, then the symptomatic treatment should be to prevent secondary changes in the urine, as decomposition and fermentation, which are favored by the presence of pus and pus-producing micro-organisms. The treatment of this consists in the giving of urinary antiseptics, as the balsams, oil of sandalwood, oil of copaiba, urotropin, benzoate of soda, benzoic acid.

The indications for the use of these drugs are fully discussed under Pyelitis and Cystitis.

ALBUMINURIA

From a diagnostic standpoint the most important of the abnormal constituents of the urine is albumin due to the passage into the urine of blood-serum from the blood-vessels of the kidney, or from some other part of the genito-urinary tract.

Various classifications of albuminuria have been made, based either on—(*a*) the supposed pathologic condition allowing of the passage of albumin into the urine; (*b*) the specific cause; (*c*) the source of the albumin, whether renal or not; and (*d*) the association of the albumin with certain diseased conditions other than renal.

The following forms of albuminuria may be recognized clinically:

1. **Accidental albuminuria,** also named by West post-renal albuminuria. In this form the albumin is dependent upon some change in

the genito-urinary system, other than the blood-vessels of the kidney proper, such as inflammatory conditions of the pelvis of the kidney, ureter, bladder; from the urethra in the male and the vagina in the female. Albumin derived from these portions of the genito-urinary tract may be small in amount and associated with pus and other cellular elements. When the inflammation extends to the kidney, casts and other evidences of nephritis may be added.

2. **Renal albuminuria**: In this form the albumin is derived from the renal blood-vessels. Two types of this occur: (*a*) Albuminuria due to organic change in the kidney, which can be clinically determined as acute congestion of the kidney, passive congestion of the kidney, and different forms of acute and chronic nephritis; (*b*) albuminuria occurring in cases that clinically do not show any definite pathologic cause for the same. While the normal urine never contains albumin in any appreciable quantity, a large number of apparently healthy people may have albumin present in the urine in small quantities. Dickinson claims that 30 per cent. of all persons examined may show albumin. To this type of albuminuria special names have been given according to the supposed source of the albumin, the conditions causing it, or with which it is associated.

Physiologic or functional albuminuria: This name is given to those cases in which clinically can be found no evidence of any pathologic change in the kidney, or symptoms of nephritis, beyond the presence of albumin in the urine. In this form albumin may be constant or vary slightly in amount. Subdivisions of this form of physiologic albuminuria are:

(*a*) *Intermittent albuminuria*, in which the albumin is not constantly present, but its occurrence does not follow any rule.

(*b*) *Cyclic albuminuria:* In this form albumin appears at certain times of the day, or may be associated with the taking of food, bathing, exercise, etc.

(*c*) *Dietetic albuminuria:* In this form, after the taking of certain foods, especially the proteins, or even after an excessively large meal, a small amount of albumin may be present. In other cases the taking of large amounts of fluid or alcohol, or any articles of diet which cause free diuresis, may cause transient albuminuria.

(*d*) *Postural albuminuria:* This form of albumin is present in the urine only when the patient assumes the upright position, has been on his feet for a long time, or has taken violent exercise. Under the latter circumstance not only albumin but blood may be present. On assuming the recumbent posture the albumin rapidly disappears.

(*e*) *Albuminuria of adolescence:* This occurs only in young persons who are somewhat debilitated. These cases are usually anemic, easily tired, and complain frequently of headache. Although they show no evidence of any cardiac or vascular disease, while standing quietly in a class-room, church, etc., they may suddenly faint, and on examination albumin may be found in the urine.

Various opinions have been expressed as to the cause and diagnostic significance of albuminuria in the seemingly healthy. Before any case can be classified as physiologic or functional albuminuria, it is necessary to exclude all pathologic conditions of the kidney and genito-urinary tract, and diseases in which albumin may appear in the urine as a symptom, as toxemia and febrile conditions. Whenever any symptom of uremia is present, even in a mild degree,—dropsy, cardio-vascular change, or any symptom that is usually present in diseases of the kidney,—the diagnosis of non-pathologic albuminuria must be made with great caution, and then only after the patient has been under careful observation for a long time.

While in the physiologic or functional albuminuria the kidneys cannot be considered actually diseased, still there must be some defect either in the blood-vessels or in epithelium lining the tubules or covering the glomeruli, which renders them more permeable to albumin. This condition may be induced: (*a*) By permanent or intermittent congestion of the abdominal organs, which raises the blood-pressure in the renal veins or obstructs the rate of flow through the vessels; (*b*) by changes in the blood which interfere with its nutritive quality or its oxygenating power, or increase its viscosity, and so interfere with the flow through the renal vessels and their nutrition; (*c*) by toxic or irritating substances in the blood, due to faulty metabolism, imperfect digestion, or absorption of products of fermentation or putrefaction from the intestinal canal or taken as food or medicine.

The treatment of accidental and pathologic albuminuria will be considered under the disease which it accompanies. Management and treatment of non-pathologic albuminuria are determined by the supposed cause and the conditions associated with it.

In albuminuria occurring without any symptoms, and not showing any tendency to vary with diet or posture, exercise, etc., there should be no marked restriction of the diet, which should be varied, but should not contain those substances which are known to irritate the kidney. Careful observation of the effect of different articles of diet should be made in these cases, so as to see whether the albumin is increased by any of them. The ordinary mode of life as regards exercise and work should be carried out. Patients should not be housed too closely, nor should they be made to consider themselves invalids. The bowels should be carefully regulated, and all conditions which cause congestion of the abdominal organs should be avoided. Tendency to anemia should be combated with a non-astringent preparation of iron. Excessive doses are not indicated. The giving of drugs to control the albuminuria *per se* is useless, although some claim that ergot, ♏xv to xx, t. i. d., aids in controlling it.

In the intermittent, cyclic, postural, and dietetic forms of the disease the exciting factors of the albuminuria should be controlled as far as possible without interfering with the general well-being of the patient. If the diet and exercise are too far restricted, while the amount of albumin may be temporarily removed from the urine, the patient suffers in general health.

In postural albuminuria the use of drugs acting upon the peripheral circulation, such as small doses of strophanthus, digitalis, and ergot, is often advantageous. If patients show tendency to ptosis of the abdominal organs, a suitable supporting bandage should be worn. Massage and gymnastic exercises to develop the abdominal muscles are often effective.

In the albuminuria of adolescence the patient should continue the regular mode of life of his associates. Stability of the cardiovascular system should be increased by tonic cold baths, followed by brisk rubbing. Iron, combined with small doses of digitalis or strophanthus, generally controls it. As these patients generally faint while standing in a class-room or in church, they should avoid these circumstances. They should be encouraged to exercise within their capacity. Wine and special stimulants should not be given. In many cases of "physiologic albuminuria" the condition persists for years, uncontrolled by treatment, and without any evidence of progressive renal disease.

UREMIA

Uremia is a toxemia associated with imperfect functional activity of the kidneys. The exact chemical composition and mode of production of the poison or poisons producing the condition are unknown. The most prominent theories concerning the nature of uremia are:

1. That the symptoms are due to the normal constituents of the urine, which are retained in the blood, owing to excretory deficiency of the kidney. While in uremia there is a larger amount than normal of nitrogenous elements in the blood, uremic symptoms cannot be induced by the injection of urea or other nitrogenous substances.

2. That the symptoms are due to the presence in the blood of some toxic substance other than the normal constituents of the urine, the result of disturbed metabolism caused by the renal lesion.

3. That the kidney has an internal secretion, and the deficiency of this secretion is the cause of the uremic condition.

As the symptoms of uremia vary greatly in character, it is probable that the nature of the poison varies in different cases and at different times, according to the lesions of the kidney and its impaired function.

The symptoms of acute uremia have been ascribed—(1) to action of the toxins on the nerve-cells; and (2) to the effect on the nerve-centers of mechanical pressure due to the effect of the poisons on the cardiovascular system, and to the resultant high blood-pressure.

The changes in the brain that produce the symptoms have been ascribed to effusion into the ventricles and consequent anemia of the brain, arrested cerebral circulation from increased intracranial pressure without effusion; or the opposite—increased circulation of the brain.

The nature of the uremic toxemia being unknown, there is no chemical antidote. On the supposition that imperfect oxygenation of the products of metabolism is the cause, the use of oxygen has been advocated, and certain observers have reported a marked improvement under its use, especially in cases where the patient shows slight cyanosis, either before the occurrence of acute uremic symptoms or during the attack,

While the nature of the uremic poison or poisons is not known, there is general agreement that the symptoms are due to the retention in the blood of some toxic material; and that the symptoms vary not only with the amount of the poison, but also with its character, according as the nerve-cells are affected directly or influenced by the effect of the toxin on the cardiovascular system.

It is most important to remove from the blood as quickly as possible the cause of the symptoms, and the main reliance is to increase the action of the kidneys, and supplement their eliminative action by that of other organs, especially the skin and bowels.

When the toxemia is very acute, venesection may be employed. This is especially indicated when the uremia occurs in acute nephritic conditions, or in a previously robust patient with a pulse of high tension. In such a case from 12 to 24 ounces of blood may be removed. If the removal of this amount of blood reduces the blood-mass too much, as shown by the effects upon the tension of the pulse, normal salt solution may be introduced to replace part of the blood. If it is desired still further to dilute the blood, twice the amount of saline solution to the amount of blood taken may be introduced. In weak and debilitated patients, or in uremia occurring in chronic cases, venesection is not well borne, and the relief of the symptoms is more than counterbalanced by the depression that follows it.

Increased elimination by the kidneys is generally impossible when uremia occurs in acute diseases of the kidney. The stimulation of the kidneys by diuretics increases the inflammatory condition. In certain conditions where toxemia is profound, and the need of rapid elimination urgent, it may be necessary to try to increase diuresis notwithstanding its effect upon the kidneys. The condition of the circulation determines largely the form of diuretic used. With a pulse of high tension and excessive cardiac action, reduction of blood-tension by the use of the nitrites, combined with the administration of diuretin, agurin, or theocin, gives an increase in the amount of urinary water as well as the solids.

When the blood-tension is high, but cardiac power relatively insufficient to overcome the obstruction due to contraction of the arteries, digitalis or strophanthus, or other members of the group, in combination with the theobromin preparations, act the best. Saline diuretics, especially the acetate of potash, bitartrate of potash, either alone or in combination with nitroglycerin or digitalis, as indicated, may be substituted for the theobromin. The use of the more stimulating and irritating diuretics is not justifiable.

In chronic diseases of the kidney uremia is the result of a gradual accumulation of poisons, and the symptoms are those of an acute autointoxication, added to a chronic or latent toxemia. In these cases the danger of stimulating the kidneys by the different forms of diuretics is much less than in the acute inflammatory type, although the uremia may be associated with more or less acute changes in the kidney.

In cases accustomed to take alcohol—beer or other alcoholic beverages—the kidney function has been carried on so long, under such stimulation, that the withdrawal of the alcohol is at times followed by marked reduction in the amount of urine and symptoms indicative of uremia.

The direct stimulation of the kidney by the use of the caffein, theocin, or theobromin preparations, or use of the infusions of scoparius, ½ ounce, or infusion triticum repens, ½ ounce, is especially serviceable in these cases.

In chronic kidney disease the effect of changes in the circulation upon kidney function is most important; as long as the cardiac hypertrophy is associated with a high tension that is not excessive, a sufficient elimination by the kidneys occurs. When the cardiac power becomes insufficient, either through degenerative changes in the heart muscle or excessive high tension in the blood-vessels, the elimination becomes deficient and symptoms of uremia occur, and it is necessary to decide whether it is best to increase cardiac power by the use of drugs acting directly upon the heart, as digitalis and strophanthus, or to lower the blood-tension by the use of nitrites, as chloral, etc. Frequently, by the combination of cardiac stimulants and vasomotor dilators, both purposes are accomplished.

In acute uremia the action of digitalis and strophanthus must be carefully watched; if they do not regulate the pulse and produce an increased flow of urine, there is danger in increasing the dosage or continuing their use. The occurrence of increased dyspnea, somnolence, or cardiac distress during their administration should always raise the question as to whether these symptoms are due to the untoward action of the drugs.

The rules governing the use of diuretics and cardiac stimulants in the treatment of uremic symptoms occurring in acute and chronic disease of the kidneys are more fully considered under Acute Nephritis, Chronic Parenchymatous Nephritis, and Interstitial Nephritis.

Prof. Wm. H. Thomson has called attention to the influence of aconite in lowering blood-pressure, and at the same time increasing the output of urea by the kidneys. In the treatment of that form of uremia that occurs in pregnancy (puerperal eclampsia) veratrum viride, 10 minims every two to four hours, has been found to control the convulsion through lowering the arterial tension.

Elimination by the bowels is important from two standpoints: (1) To prevent the absorption from the intestines of substances which are usually thrown off by the kidney, and, being retained in the blood, would add to the toxemia; (2) to induce vicarious elimination by the bowels so far as the normal constituents of the urine are concerned.

As uremia is usually attended by nausea and vomiting, the choice of a cathartic is often a difficult question. The saline cathartics, when they can be retained by the stomach, meet the indications. Potassium tartrate, Epsom salts, and the effervescing solution of citrate of magnesia are the ones most generally used. When elimination of water as well as the other constituents of the urine is desired, the saline purgatives should be given in as concentrated a solution as possible. Compound jalap powder (ʒss to ʒj) has long been a favorite cathartic in uremia. It can be given for a long time without producing intestinal irritation. When the stomach is irritable, it is not well borne. Elaterium (gr. $\frac{1}{10}$ to $\frac{1}{6}$) or elaterin (gr. $\frac{1}{20}$ to $\frac{1}{10}$) may be given every three to four hours until thorough catharsis is produced. If combined with extract of hyoscyamus (gr. $\frac{1}{8}$ to $\frac{1}{6}$), the tendency to griping is controlled. The claim has been made for elaterium that it has the power to increase the elimination of nitrogen by the intestines, especially when the kidney function is impaired; given in smaller doses (gr. $\frac{1}{20}$ to $\frac{1}{15}$), two or three times a day, without producing marked purging, it often rapidly removes many of the symptoms of acute and chronic uremia and reduces the edema.

Calomel, either alone or in combination, is believed by many to be the best cathartic. It may be given in small doses, frequently repeated (gr. $\frac{1}{10}$ every fifteen minutes for ten doses). Many advocate giving it in this manner when there is marked nausea and vomiting, claiming that in addition to its cathartic effect it allays the irritation of the stomach. When prompt action is desired, calomel (gr. x), combined with sodium bicarbonate (gr. xx), or compound jalap powder (ʒss to ʒj), is most efficient. When the patient is unconscious, croton oil, one or two drops upon the tongue, may be used.

The skin shares with the kidney the function of eliminating from the blood a number of substances which, if retained, would be poisonous. By the skin is eliminated sodium chlorid, 23.5 parts per thousand, small quantities of alkaline sulphates and phosphates, urea, uric acid and ethereal substances, phenol, skatol, etc.

The complemental action of the skin to the work of the kidneys renders it especially important not only that in all diseases of the kidney the functional activity of the skin be kept to the normal, but that it be stimulated so as to have a vicarious action. In uremia this vicarious action must be induced by the hot-air pack applied in the form of Turkish baths, portable Turkish baths, hot-air apparatus for the bed, electric-light bath, or the hot blanket pack. As patients with acute uremia are generally too sick to use a public Turkish bath, it is necessary to employ either the portable Turkish bath or hot air introduced under the bed-clothing. If the patient is able to sit up, he may be placed in a portable Turkish bath, or a similar apparatus may be extemporized by placing the patient on a stool and pinning about his neck rubber sheets or blankets; by the use of chairs, barrel-hoops, and other means, the covering can be held away from the body so as to allow the necessary air-space. The covering should come well down on the floor and be adjusted so as to retain the air as much as possible.

When the patent is confined to bed, a hot-air bath may be given in the following manner: The mattress is protected by a mackintosh, upon which is placed a blanket; the bed-covering is made a tent by means of a cradle of barrel-hoops, etc.; over the bed-clothing is put a rubber sheet or mackintosh; the clothing is adjusted tightly about the patient's neck and around the edges of the bed, so as not to allow the escape of hot air. The patient's head should be covered with a cold compress. Hot air is introduced under this covering by lighting an alcohol lamp (this must be used with great care on account of burning the patient or setting fire to the covering), or an ordinary spirit or kerosene lamp may be used outside of the cabinet and the hot air led under the covering by means of a section of stovepipe with elbow attached, or, if it is not available, through tubes made of heavy cardboard or asbestos paper. Care must be taken, when inflammatory material is used for tubes, that it does not take fire. A temperature of 120° to 200° F. may be produced under the covering. A temperature of 140° to 160° F. is generally sufficient to produce free diaphoresis. The introduction of moist air, as steam from a kettle, etc., may also be tried, but while perspiration is more readily induced, it does not have so marked an eliminative effect as that induced by dry heat.

The electric-light bath has been lately introduced, and it is claimed that it is much more efficacious than the dry hot-air bath. Since the introduction of electricity for lighting purposes facilities for giving this bath have increased. A number (six to ten) of electric-light bulbs are fastened together and introduced into the cabinet or under the bed-covering, which has been arranged in a manner similar to that used for giving the hot-air bath. The advantages of the incandescent electric-light bath are the ease and safety of application and the rapidity with which the skin is stimulated. Free perspiration in the electric-light bath usually occurs in from three to five minutes; while in the hot-air bath the effect is not obtained under fifteen to twenty minutes, and even longer. The retained heat from the incandescent electric-light bulbs acts on the skin to produce perspiration without raising the temperature of the surrounding air to an uncomfortable degree; and profuse perspiration occurs with the air not raised above 85° to 95° F. The stimulation of the sweat-glands and other structures of the skin is influenced in a much more powerful manner than in the hot air alone. The surrounding air not being very hot, there is no interference with heat elimination. In electric-light baths the superficial vessels are fully relaxed and the amount of perspiration is considerably greater than that induced by ordinary heat. When profuse perspiration is needed, it may be continued from fifteen to twenty minutes. Too long an exposure must be avoided, as it frequently produces marked depression. When the dry hot-air or electric-light baths are not possible, the hot blanket pack is very efficacious. A woolen blanket is wrung out of hot water and applied as hot as the patient can bear it; over the wet blanket dry ones are applied, and outside of this an impervious cover, as a rubber sheet. In applying the blanket next to the body, care must be taken that it is carried between the arms and the body, and also between the legs, as this insures not only more complete perspiration, but is much more comfortable.

The frequency and duration of the baths will depend upon the severity of the case; when toxemia is profound, they may be given daily or even oftener, and may be continued for twenty minutes to an hour, the depressing effects of the sweats being always considered. When the toxemia is less and purgatives are also used as prophylactics against uremia, baths may be given for a short time daily, or on alternate days. After the patient is removed from the bath, his skin should be dried without chilling, and he should be briskly rubbed with dry towels and then wrapped in a woolen blanket. The sweating is increased by giving hot drinks, the action of which is increased by the addition of aromatic substances and saline diaphoretics, such as spiritus ætheris nitrosi and liquor ammonii acetatis.

Pilocarpin is the most powerful of the internal diaphoretics, and when hot-air baths are not available, it may be used to produce free diaphoresis. When given, the patient should be placed in the most favorable condition for free sweating. He should be closely covered with blankets, and hot-water bottles should be placed at his feet and about his body. The pilocarpin is given hypodermatically in from $\frac{1}{4}$ to $\frac{1}{3}$ grain doses. Perspiration is induced in from fifteen to twenty minutes, beginning usually first upon the face. If the first dose fails to induce perspiration, it may be repeated in half an hour. When pilocarpin hydrochlorate is not available, a fresh infusion of jaborandi leaves, in 3 to 4 ounces of water, may be introduced into the rectum, or from ½ dram to 4 drams of the fluidextract of pilocarpin, in the form of a suppository, may be used. In using pilocarpin its tendency to produce secretion from mucous membranes as well as from the skin must be remembered; profuse salivation is nearly always present. When it does not act freely upon the skin, the danger of producing free secretion in the bronchial tract, and causing suffocation and pulmonary edema, is very great. Occasionally it increases secretion from the stomach, causing persistent nausea and vomiting. After its use the patient is prostrated, and frequently demands free cardiac stimulation.

The control of uremic convulsions is most important. The means used are chloroform inhalations, chloral hydrate and its allied drugs,—sulphonal, trional, etc.,—the bromids, spiritus ætheris compositus, the nitrites and nitroglycerin, opium and its alkaloids.

Chloroform inhalation will temporarily control the spasms, but has no influence whatever on the uremic condition. Chloral hydrate may be given either by mouth (gr. x to xv) or by rectum (gr. xx to xxx). The dose may be repeated once or twice at half-hour intervals, and later at hour intervals, until the spasms are controlled. In giving repeated doses care must be taken that absorption has taken place, especially when given by rectum. Occasionally the drug is retained in the stomach or rectum for an indefinite period, and with the cessation of the convulsions is suddenly absorbed and the patient narcotized. The advantage of chloral over chloroform is that, while its action on the nervous system is the same, it is more persistent. Like chloroform, it has no action on the toxemia.

Two to 4 drams of spiritus ætheris compositus in 4 to 6 ounces of normal saline solution, introduced into the rectum, acts as a sedative and will control the convulsions when chloroform is not available or is contraindicated. It may be repeated in one to two hours. By its use it is possible to produce a mild form of narcosis.

The nitrites and nitroglycerin have very little influence on the convulsive seizures except when they are due to a high arterial tension. Their action is extremely transient.

The use of opium and its alkaloids for the control of uremic convulsions has been both advocated and condemned. The late Prof. A. L. Loomis strongly recommended the employment of morphin hypodermatically in the treatment of uremic convulsions occurring in acute types of nephritis. It is given in ¼- to ½-grain doses and repeated frequently enough to control the convulsive seizure. Those who have restricted its use to the treatment of uremia occurring in acute kidney conditions have seen no bad effects. The uremic convulsions are controlled and the cardiovascular system quieted, and there is increased diaphoresis. In many cases it also seems to influence beneficially the functional activity of the kidney. Its use in uremia that occurs in chronic nephritis is not devoid of danger; while it may control the uremic convulsions, it increases the tendency to coma and interferes with the eliminative function of the kidney. The continued use of opium to control the uremic symptoms, in either acute or chronic diseases of the kidney, is bad.

Increased arterial tension is so definitely associated with the occurrence of convulsive seizures that it demands special treatment. The increase in tension may be persistent, or it may occur suddenly and be followed by the convulsion. In extreme cases venesection may be needed. The amount of blood taken should be governed by its effect upon the tension, which should be definitely lowered.

The nitrites lower the tension but momentarily, and their use is apt to be followed by an increase in tension. When used, they should be given in doses just sufficient to influence the tension, and be repeated frequently enough to control it.

Many of the drugs given to act upon the nervous symptoms of uremia have a controlling effect on the circulation also. This applies especially to chloral. Given in full doses it promptly controls the spasm and lowers blood-tension for a longer time than any other means at our command.

Dyspnea is a frequent symptom of uremia. It may occur in paroxysmal asthmatic attacks or without the sibilant and sonorous râles. The breathing is of a peculiar hissing character; at times it may become Cheyne-Stokes in type.

Dyspnea is due to the action upon the nervous system or upon the circulation of the toxemia; and from a therapeutic standpoint it should be considered but another form of spasmodic seizure.

The treatment of this local spasm is practically the same as that of the convulsive seizure. Treatment directed to the respiratory tract itself is of but little use.

Gastro-intestinal symptoms that occur in uremia, as nausea, vomiting, and diarrhea, are all evidences of the toxemia. Treatment directed toward the intestinal tract alone rarely accomplishes any good. The nausea, vomiting, and diarrhea may be to a certain extent eliminative, and should not be stopped unless debilitating the patient.

The use of opium or morphin for control of nausea and vomiting is contraindicated. The use of stomach-washing and enteroclysis often gives relief.

The paralytic form of uremic attack may occur either as a hemiplegia or as a localized paralysis. In paralytic conditions lasting for a short time the paralysis is largely due to the disturbed circulation of the brain and its attendant anemia or hyperemia. It is impossible, in many cases, without a full knowledge of the previous kidney condition, to say whether the paralysis is due to a rupture or thrombosis of a cerebral vessel, or is a symptom of the uremic condition. When there is a history of acute or chronic kidney disease and other symptoms of uremia, the treatment of the paralytic condition should be that of an acute uremic attack.

ECLAMPSIA

Closely allied to uremia is the blood state which gives rise to gestational convulsions, and which, since it is an obstetric subject, is dealt with here only incidentally. When eclampsia appears to result from the so-called pregnancy kidney, the resemblance to the uremia of acute parenchymatous nephritis is striking, because in either case complete recovery often occurs. Pregnant women sometimes develop true acute nephritis, so that in such cases differentiation is hardly possible. True pregnancy kidney, however, is held to be the effect, not the cause, of eclampsia, while there is little doubt that uremia is purely a retention phenomenon, due always to insufficiency of the kidneys. In the blood state which leads to pregnancy kidney these organs are not necessarily involved. Eclampsia in rare instances occurs with normal kidneys and urine free from albumin. It is claimed that the liver always presents lesions in eclampsia, also that if such lesions are not discoverable, the general condition clearly shows a functional insufficiency of the liver. Hepatic lesions and insufficiency have no necessary connection with uremia.

It is well attested that pregnant women with chronic interstitial nephritis exhibit convulsions in a very small per cent. of cases only—according to authorities about 3 per cent. It is impossible to state whether in a given case such conditions should be termed uremic or eclamptic.

There is no doubt that a vicious circle is in evidence in eclampsia, as may also be the case in uremia following acute nephritis due to toxic agencies in the blood. The circulating toxins may or may not set up a renal lesion. If they do cause an inflammatory or degenerative alteration of the parenchyma of the organs, obstructive phenomena will result with retention toxemia added to the original toxemia. Hence it may sometimes be possible for eclampsia and uremia to exist side by side.

ACTIVE CONGESTION OF THE KIDNEYS

Active congestion of the kidneys is a transient disturbance of the renal circulation, which may cause exudation of serum and cellular elements of the blood into the uriniferous tubules.

Temporary congestion of the kidney may be caused:

1. By chilling of the body, as prolonged exposure to cold, cold baths, etc. The above may cause active congestion of lungs, kidneys, or other organs, according to certain determining factors.
2. By action upon the kidney of some irritant, either chemical or bacterial, as cantharides, oil of mustard, turpentine, cubebs and copaiba, potassium chlorid, potassium nitrate, antimony and its compounds, or toxins of acute infectious disease.
3. By injury or surgical operation on any part of the body, especially upon the genito-urinary tract.
4. By acute congestion after overexertion.

The urine is diminished, small quantities being passed at a time, or it may be suppressed; there may be pain or strangury. The urine contains albumin and granular, epithelial, or blood casts. With the urinary symptoms there may be slight rise in temperature, pain in the back and abdomen, nausea, vomiting, diarrhea, prostration, delirium, and constipation.

The symptoms present in this condition depend in part upon the nature of the exciting cause and its power to affect other organs, and in part upon the disturbed function of the kidney.

In severe cases active congestion of the kidney may pass into that of an acute inflammatory condition described under "Acute Nephritis." When congestion of the kidney is milder and the irritation transient, the urine returns to a normal condition in a short time.

The treatment consists of:

1. Prophylaxis. Persons who are exposed through their occupation to poisons which can become kidney irritants should guard against their introduction. This is necessary for painters, where, in addition to the turpentine, there is danger of lead-poisoning. The administration of drugs that are liable to produce kidney irritation should be always kept in mind and avoided in conditions in which there are apt to be complicating diseases of the kidney, as in scarlet fever, diphtheria, the use of carbolic acid in the treatment of surgical diseases, and also the use of iodoform and iodin compounds in surgical dressings.
2. The elimination of the poison by other means than the kidney.

When the poison can be eliminated by other avenues than the kidney, means should be taken to insure this mode of elimination, as by the skin, lungs, and intestines. Where it is possible to render the poison less harmful to the kidney by combination with other substances, such antidotes should be given.

3. Dilution of blood and urine, so that the concentration of the poison and its irritating effects may be lessened. In certain conditions venesection and the substitution of normal salines for the amount of blood taken accomplish this.

4. Combating circulatory changes in the kidney. Where the kidney is intensely congested, so that there is a temporary suppression of function, absolute physiologic rest is imperative. There should be no attempt to increase the flow of urine by giving large quantities of fluid or other diuretics. The withholding of all food and drink for twelve or twenty-four hours is often necessary. When the secretion of urine becomes freer, then diuresis may be stimulated by free use of water, diluent drinks, and the non-irritating diuretics. The faulty excretion by the kidneys may be compensated for by increased elimination by the skin and bowels, as described under "Uremia."

Withdrawal of blood from the kidneys may be accomplished by cupping over the region of the kidney, followed by counterirritation. It is necessary to avoid the use as counterirritants of all substances which, if absorbed, would increase kidney irritation, as turpentine, cantharides, etc. Hot fomentations or poultices are usually sufficient to keep up the effect of the cupping. The general treatment of active congestion is the same as that of acute nephritis.

PASSIVE CONGESTION OF THE KIDNEY

Synonyms: Passive Hyperemia of the Kidney; Chronic Cyanotic Kidney

Passive congestion of the kidneys depends upon some interference with the return circulation, which may affect the entire venous system, as when due to pulmonary or cardiac disease, or may be local, as obstruction of one or both renal veins. The kidney lesion varies with the length of time and degree and nature of the circulatory interference, and whether it affects one or both kidneys.

The effect of interference with the kidney circulation is to decrease the rate of flow of blood through the glomeruli and diminish its functional activity. The effect upon the function of the kidney is shown by the urine; the quantity is decreased, color dark, specific gravity high, due chiefly to reduction in the amount of urinary water without corresponding decrease in the solids. Albumin is present and also casts, which are chiefly hyaline, although granular casts may occur. Blood is not usually present in simple passive congestion, except a few isolated red blood-corpuscles. If a large amount of blood is present, it always points to some complication, either a nephritis or hemorrhagic infarction.

The treatment of passive congestion of the kidney is determined by the nature of the cause, and its success depends upon the power to remove the interference, or, if this is impossible, to compensate for it.

When the obstruction to the circulation is in the kidney itself, as neoplasms or thrombosis of the renal vein, little can be done. This condition usually involves only one kidney, and the function of the other kidney should be conserved by reducing the demands made upon it. The rules governing diet, amount of fluid taken, relief by action of skin, bowels, etc., are the same as described in chronic interstitial nephritis. If the thrombosis of the renal vein is recent, alkalis may be given to aid in the resolution of the clot. If organization of the clot has taken place, all treatment to favor its removal is useless.

Pressure upon the renal vein cannot be compensated for by drugs without disturbing the whole vascular system; surgical interference is here called for.

When renal congestion is due to interference with the return circulation through obstruction in lungs, heart, or pericardium, the indications are to increase cardiac power and so reëstablish the normal rate of flow through the kidneys. In order to accomplish this it is necessary to increase the force and pumping power of the left side of the heart, so as to raise the blood-pressure in the kidney and the rate of flow through the glomeruli. This can often be accomplished by tincture of digitalis, tincture of strophanthus, or other cardiac stimulants. With increased muscular power of the heart, not only is the blood propelled more forcibly into the arteries, but the suction power of the ventricles is raised and the venous flow increased.

In long-standing or severe cases general edema is usually present, and the increased amount of fluid in the vascular system and in the tissues of the body still further increases the work of the heart and the kidneys; it becomes necessary to relieve the edema and to reduce the blood mass before it is possible to reëstablish the normal rate of flow through the kidneys.

The means employed to reduce the edema are:

1. Diminution in the amount of fluid taken as food or drink. The diet should be dry, and only as much fluid allowed as will allay thirst to a certain degree (for these patients are generally very thirsty, although water-logged). The quantity of fluid taken should be considerably under the amount of urine passed, even although the patient is losing fluid by the skin or bowels.

2. Purgation: The patient should have a number of watery passages a day—in some cases as high as six or eight a day. The form of cathartic must be governed by the individual requirements and idiosyncrasies of the case. The cathartic should not disturb the stomach or cause intestinal irritation. If the saline cathartics are given, they should be administered in as concentrated a solution as possible. If the simple salines are not sufficient, then the hydragog cathartics may be substituted. If the mercurial preparations are used,

their free elimination must be insured by proper combination or use of salines. Small doses of elaterium are often very efficacious.

3. Diaphoresis: The use of hot-air baths, electric-light baths, or Turkish baths is beneficial. These are not as efficacious as the restriction of fluid and purgation, and are more apt to distress and weaken the patient.

4. Drainage: When the fluid has collected in the serous sac, or the subcutaneous tissues are very much infiltrated, it may be necessary to remove the fluid by aspiration from the serous sacs or by puncture of the skin. This should be done with all aseptic precaution, on account of tendency to suppuration in patients with disturbed circulation and low vitality.

After the reduction of edema the use of digitalis or strophanthus, either alone or in combination with caffein, theobromin, or theocin preparations, is followed by increase in cardiac power and marked diuresis, and the further removal of the edema.

In advanced cases of passive congestion with edema and diminishing urine the use of diuretics should not be begun until after the edema and overfilled venous system have been relieved.

After the circulation has improved and function of the kidney has been reëstablished, the subsequent management and treatment of the case are to so regulate the circumstances and mode of life of the patient, and to combat the complications, as to prevent failure of the circulation and the return of edema.

Stimulation of the kidney by diuretics is of only secondary importance. Sooner or later in all cases (unless terminated by some other condition) there comes a time when the power of the heart to compensate fails and the patient becomes permanently edematous. But even then much can be done by judicious management and symptomatic treatment to make the patient comfortable and to delay the inevitable time when all means fail to relieve the distress of edema and dyspnea.

ACUTE NEPHRITIS

Acute nephritis has been described as acute diffuse nephritis, acute desquamative nephritis, acute tubular nephritis, acute catarrhal nephritis, acute croupous nephritis, albuminous nephritis, hemorrhagic nephritis, acute Bright's disease, acute albuminuria, acute renal dropsy, epithelial nephritis, glomerulonephritis. These different names have been given largely in the attempt to designate the portion of the kidney that is primarily or chiefly involved or to indicate the nature of the process.

There is great difficulty in making a definite classification of the acute and chronic diseases of the kidney from a therapeutic standpoint. A satisfactory classification, based on causes, is at the present time not possible. A classification according to the part of the kidney primarily or chiefly involved is possible only to a certain degree, but is helpful both clinically and therapeutically. A classification according to the nature of the morbid process, while possible for the pathologist, is clinically impossible, as, with our present methods of diagnosis, we cannot differentiate the various types according to the anatomic changes, which may be congestive, degenerative, exudative, or productive alone, or, what is more common, these processes may be combined in varying degrees.

For the purpose of clinical diagnosis and of treatment it is only possible to determine approximately what portion of the kidney is primarily or chiefly involved, and to estimate the nature of the probable changes from the history of the case, which includes all factors which may influence kidney function. What is more important than a hard and fast pathologic diagnosis is a correct understanding as to how extensively the renal functions are disturbed, and of the indications for the treatment.

Bradford* has called attention to the importance of distinguishing two types of acute diseases of the kidney. One type, while affecting the kidney function more or less profoundly, runs an acute course, lasting not more than four to six weeks, and inflicts no permanent damage on the kidney, the patient making a perfect recovery. Absence of persistent edema is a distinguishing feature. This type includes transient nephritis, febrile albuminuria, metabolic and toxic nephritis, and the kidney involvement that is present in most of the acute infectious diseases. The other type, which may be ushered in by the same symptoms, and be dependent to some degree on the same causes, damages the kidney permanently and is accompanied by marked and persistent edema. This type may occur in diphtheria, pregnancy, as a post-scarlatinal nephritis, or may occur as a primary nephritis of unknown origin.

Although it may be impossible to determine clinically the exact pathologic changes that are occurring in the kidney, we know with certainty that the glands are more or less acutely inflamed and that the excretory function is disturbed. The objects of treatment are:

1. To relieve the renal hyperemia by the removal of the cause, if possible. If it is dependent upon the toxemia of one of the infectious diseases, to diminish this toxemia by the control of the primary disease, or by lessening the concentration of the toxins in the blood and inducing elimination by other channels when the kidney is irritated.

2. To secure physiologic rest for the kidney by reducing its functional activity as far as possible, while at the same time maintaining a constant flow through the tubes to keep them clear, but without injury to the gland.

3. To diminish the danger of further or permanent damage to the kidney.

To influence the morbid processes and abate the renal hyperemia the patient must be put to bed in a warm room. The temperature of the room should be warmer than that of an ordinary sick-room or hospital ward, but should not be uncomfortable, and the air of the room should be kept as pure as possible. The patient should be protected from chilling, some advising that he should be clothed in woolen garments and placed between woolen sheets.

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* Croonian Lectures, 1904.

The circulation of the kidney may be affected by local applications, as hot applications and counterirritation over the lumbar region, or by dry cupping. The object is to bring the blood to the surface by directing it into the lumbar arteries. The vacuum in the dry cups should not be so great as to injure the superficial capillaries and produce ecchymosis, as this would defeat the object of the treatment by blocking up the capillaries. After the dry cups, a hot fomentation should be applied over the back or entire lower portion of the trunk. In very severe cases wet cups may be employed. The local blood-letting by means of the wet cups should be used only when the case is a very severe one, and the patient can lose a certain amount of blood without detriment. It is also necessary to keep the feet warm constantly, as the renal circulation is markedly affected by chilling of the lower extremities.

Circulation of the kidneys may also be modified by hot rectal irrigations or enteroclysis with normal salt solution. Continuous irrigation is given for from ten to fifteen minutes. An ordinary long rectal tube may be used, or, what is better, a double tube (Martin's, Tuttle's, or Kemp's). The temperature of the water may vary from 102° to 120° F., 110° F. being that most commonly used. Large quantities of the water should be used. Kemp advises that the outlet tube should be narrowed so that from one pint to one quart of the solution be kept constantly in the bowels. By the retention of a certain amount of water continuously in the large intestine, absorption takes place from the pelvic vessels which stimulate the flow of urine through the kidneys. The heat of the solution affects the renal circulation reflexly and diminishes the hyperemia. Aconite, 1 or 2 minims every hour until there is well-marked reduction in the force of the circulation, has been recommended by a number of authors.

The claim has been made that it is not only a sedative to the general circulation, but influences directly the renal hyperemia.

The use of the above methods to relieve the hyperemia in acute nephritis will depend upon the severity of the case. In mild cases putting the patient to bed in a warm room, warmly clothed, hot applications to the back, mild diaphoresis, and a thorough relieving of the bowels by saline cathartics, may be all that is necessary. In the more severe cases the treatment must be more energetic, and must be persevered in as long as there is hope of modifying the pathologic processes in the kidney.

As the skin shares with the kidney the function of eliminating from the blood substances which have the power of stimulating or irritating the kidney and increasing its hyperemia, free diaphoresis should be induced by hot-air baths, by the hot pack, by the electric-light bath, or by pilocarpin. The method of applying these means and their indications have been considered under "Uremia."

The congestion of the kidneys may also be influenced by purgation. The action of the bowels is a most important one in diminishing the work of the kidney. Substances normally found in the urine are absorbed from the intestines and thrown off by the kidneys. By free action of the bowels the absorption of these products is prevented. The amount of urinary water is also diminished when the movements of the bowels are liquid. It has been proved that when the movements of the bowels are solid the feces contain but a small amount of chlorid of sodium. On the other hand, when they are liquid they contain a larger percentage, while the amount of the chlorid in the urine is diminished. The cathartic used should produce free and copious movements of the bowels, but the medicine should not contain any ingredients which will be absorbed in the blood and cause renal irritation through elimination by the kidneys.

The saline purgatives, especially sulphate of magnesia, the compound jalap powder, or elaterium, meet the indications. Many authors advise the use of the more drastic purgatives. As it is necessary for the bowels to be kept active for some time, no cathartic should be used which may induce secondary inflammation of the intestines. Some writers claim that mercury is contraindicated in acute diseases of the kidney, as it is liable to cause secondary irritation of the kidney when it is absorbed from the intestine. The insoluble preparations, as hydrargyrum cum creta or blue mass, when given in connection with other purgatives, are not absorbed and do not irritate the kidney. Calomel, when given at night and its action not obtained until ten or twelve hours later, may produce some kidney irritation through absorption. When given in small divided doses, $\frac{1}{10}$ grain every fifteen minutes until a grain is taken, or when combined with pulvis purgans and a rapid action obtained, absorption from the intestines does not occur. When the mercurial cathartics are used, they should not be given continuously for any length of time.

To secure physiologic rest for the kidney by reducing the functional activity the dietetic treatment of acute nephritis is most important. When there is but slight involvement of the kidney, it is merely necessary to reduce the amount of food, and milk in these cases is the most suitable diet, or if it is not well borne, the lighter meat broths or albumin-water. As diuresis is generally free in these cases, the free use of diluent drinks is indicated.

In severe cases the diet should consist of the smallest possible amount. In extreme cases it may be necessary to withdraw practically all food for twenty-four to forty-eight hours. The thirst may be combated by allowing the patient to suck ice, or by giving very cold water in small quantities, one teaspoonful at a time. In most cases the amount of milk given should be limited to a pint and a half or two pints, and all fluid nourishment should be of the lightest kind. If there are marked cardiac weakness and small, thready pulse, it may be necessary to give small doses of alcohol in concentrated form, often repeated. The scanty diet recommended in these cases cannot be persisted in for more than three or four days, but rarely does the dangerous period persist longer than this time, and either the patient dies of uremia or the functional activity of the kidney improves.

The diet during the state of convalescence may be more abundant, especially if it was markedly curtailed during the earlier period of the disease, or if the patient has been reduced by the disease which nephritis complicates. Milk is an important part of the dietary, but not more than three pints should be given, otherwise the proteid would be too great, and would prevent offering the necessary variety of food and from increasing the nutritive value of the diet.

In addition to milk, the following may be added: white bread, legumes, cereals, oats and barley, small quantities of mild cream-cheese, and some fruits, especially grapes. Later on solid proteid in the form of meat in small quantities, either as white or dark meat, or eggs. At no time should the amount of proteid ingested be over 100 grams. The rapidity with which the diet is increased will depend upon the condition of the renal function. When the urine rapidly returns toward the normal and there is no evidence of any uremic symptoms, rather a free diet can be given.

Water has been considered the best and safest diuretic, and its free use has been advised in all cases to flush out the kidney tubules and increase the amount of urinary water. While to the normal kidneys both urea and water are physiologic stimulants, by the diseased glands they are both eliminated with difficulty, and the diminution in the amount of urinary water in acute diseases of the kidney is generally a good index of the difficulty with which water is eliminated.

In acute cases if abundance of water is given during the early stages, if it causes free urination, it is at the expense of the kidney irritation; if it does not increase the urine, it produces a condition of plethoric hydremia, with resulting overfilling of the blood-vessels and raising of arterial tension. After this has reached a certain point, edema occurs. In all acute cases where scanty urine and edema are associated, the use of water should be reduced to the lowest possible extent.

The rules for the administration of water in acute renal diseases are: When there is slight urinary disturbance and the kidney responds readily to any increase in the amount of water taken, *i. e.*, increased diuresis, water may be given freely. In more severe cases, especially in proportion to the diminution in urine and the amount of edema, water should be given sparingly, and the effect upon the kidney secretion closely watched. It is impossible to fix definitely the amount of water that should be given. The giving of milk, water, and other diluent drinks will depend entirely upon the freedom of diuresis and the amount of edema. As the kidney function increases, more fluid can be added. When, on the other hand, the urinary water does not equal 50 per cent. of the amount of fluid taken, then it is necessary to curtail the amount of water until the elimination by the kidneys equals at least 50 per cent. of the amount ingested. When diuresis falls much below the intake of fluids, edema is increased, and certain definite symptoms due to overfilling of the blood-vessels, high blood-pressure, and infiltration of the tissues with edema result.

In the treatment of acute kidney diseases undue importance has been given to the necessity of keeping up a free flow of urine without regard to what the renal condition may be, or without thought of the possible damage, both immediate and remote, that may result from trying to increase the amount of urine.

While all clinicians agree that no diuretics should be given that will irritate or unduly stimulate the kidneys, some lay stress on the importance of diminishing the acidity of the urine, claiming that the urine should be rendered alkaline as early as possible, so as to prevent the plugging of the tubules by the coagulation of albumin and blood, the acid urine increasing the coagulability of these substances, while in alkaline urine they are held in solution. The use of diuretics of different types in acute kidney diseases has been largely influenced by the theory that in all types of acute nephritis the diminished urine was chiefly due to the plugging up of the tubules by the coagulated material, and that there was danger of permanent interference with the work of the kidneys. While doubtless when a small amount of urinary water is secreted by the glomeruli, the tubes may be often more or less obstructed by coagulated material, in many cases of Bright's disease, with marked diminution in the urinary water, the tubules are found practically free.

The alkaline diuretics, especially the salts of potash and soda, are recommended as perfectly safe diuretics in these cases, as they are converted into alkaline carbonates, and are eliminated as such by the kidneys. Sir William Roberts advises the early and free administration of the citrate of potash, claiming that when the urine has been rendered alkaline during the first week of the disease, he has not, in any instance, seen uremic symptoms or secondary inflammation.

Other authors advise the giving of acetate or citrate of potash every two hours or so, largely diluted with water, and claim that anuria and uremia are avoided.

Tirard does not believe in the above, but postpones the use of the alkaline diuretics until an increase in the amount of urine shows that the engorgement of the kidney has subsided.

In acute nephritis, especially post-scarlatinal nephritis and nephritis of pregnancy, potassium bitartrate (cream of tartar) has been considered a safe and efficient diuretic, not only reducing the edema, but also modifying the urinary symptoms. It is usually given well diluted in water, half a teaspoonful to a teaspoonful to a glass of water (cream of tartar lemonade) every two or three hours, until it causes some looseness of the bowels. The value of the alkaline diuretics in acute nephritis seems to be in direct proportion to their diaphoretic and cathartic action: when they do not produce any increase in perspiration or affect the bowels, they frequently cause an increase in the anuria.

The use of those diuretics that increase cardiac action and raise the blood-pressure has been advised on the theory that the obstruction in the capillaries of the glomeruli was the cause of the anuria, and that by increasing the pumping power of the heart and the tension in the blood-vessels generally, sufficient pressure could be obtained to increase the flow of blood through the capillary loops, and so increase the urine.

In certain cases increase of the urine follows the use of these diuretics, but their use should not be a routine one, and they should be administered only when other means, as diaphoresis and free purgation, have failed to relieve the edema and the urinary symptoms due to impaired kidney function, or when the symptoms show that the acute congestion of the kidneys has subsided, and that with an increase of blood-pressure diuresis can be reëstablished without danger of irritation of the kidneys.

Digitalis, by augmenting the force and completeness of the cardiac contraction, and by constricting the blood-vessels, raises the general blood-pressure and increases the flow through the renal vessels. In addition to the effect on the blood-pressure, it is claimed that digitalis leaves contain some principles that stimulate the renal epithelium, and that these principles are most abundant in the fluidextracts and fresh infusion. In acute nephritis the action of digitalis should be closely watched. If, with the increase in blood-pressure, there is not a corresponding increase in the flow of urine, its use should be stopped. Its use should not be continued beyond two days if there is no increase in diuresis. The action of strophanthus is similar to that of digitalis. The effect on the heart is greater than that of digitalis, while its power to contract the blood-vessels is much less. It is indicated where increased cardiac power only is desired. It has the advantage over digitalis in that it is not so apt to cause gastric disturbance.

Squills has also a digitalis-like action on the cardiovascular system, but, in addition, it has a more marked stimulating and slightly irritating action on the epithelium of the mucous tracts through which it is eliminated, acting on the bronchial mucous membranes as an expectorant and upon the kidney as a stimulating diuretic.

The other members of the digitalis group also act as diuretics, but their action is not as positive as that of digitalis or strophanthus.

While the diuretic action of the digitalis group depends primarily upon their power to increase cardiac force and raise blood-pressure, they do not all produce this effect by influencing the same portion of the musculo-nervous mechanism of the circulatory system, and frequently when one member of the group has lost its power, the substitution of another member, or the combination of one or more, will cause increased action.

The increase of the urine by the use of diuretics which stimulate the functional activity of the renal epithelium is frequently advocated. The most important of these preparations are combinations of caffein, theobromin, or theocin. Their close chemical relation to the xanthin or uric acid group has led to the statement that they do not cause renal irritation, but merely increase functional activity, and can be safely used in acute inflammatory conditions of the kidney. The preparations used as diuretics are: Sodium theobromin salicylate, or diuretin (Knoll), given in doses of 15 grains, either in capsule or in solution (gr. xc to cxx per day); agurin, a double salt of theobromin and acetate of sodium (60 per cent. theobromin), in doses of 7½ grains grains (gr. xlv to xc per day), can also be given by rectum; theophyllic sodium (Boehringer), or acetate theocin sodium (Bayer), in doses of 7½ grains (gr. xlv to xc per day).

These preparations are most powerful diuretics when diminished urine and dropsy are due to primary cardiac disease. Not only is the water of the urine increased, but also its solids, especially the chlorid of sodium, and to a lesser degree the nitrogenous elements.

Granting that they do not produce in the normal kidney any irritation, in the inflamed organ they have the power of increasing the pathologic hyperemia, and so increase the intensity of the inflammation. Their use should be limited, as in the digitalis group, to those cases in which there is imperative need for elimination through the kidney, regardless of any injury that may be produced.

The stimulating, irritating, or alterative diuretics, as copaiba, uva ursi, sandalwood groups, diuretic teas, etc., should be avoided absolutely in the acute stage, as their diuretic action is dependent upon their irritating effect on the kidneys.

Control of Edema.—In acute nephritis the edema usually bears a definite relation to the diminution in the amount of urine excreted by the kidneys, and as it is impossible to stimulate or increase the amount of water lost by the kidneys, it is necessary to guard against the edema by limiting from the beginning of the disease the amount of water taken, and to increase its elimination by the skin and bowels. As before mentioned, the quantity of milk must be restricted during the acute stage, and if more nutrition is demanded than is furnished by the small amount of milk, more concentrated food must be given. In addition to restriction of the amount of water taken as food and drink, it is necessary to decrease the amount of fluid contained in the blood-vessels, lymph-spaces, and cellular tissues by free diaphoresis and purgation. When the edema has reached a certain point, a definite train of symptoms is induced, due wholly to the increased fluid content of the body. The methods of producing diaphoresis and catharsis have already been considered. (See "Uremia.")

Widal has called attention to the relation that faulty elimination of chlorid of sodium (common salt) bears to the occurrence of edema. While it has generally been supposed that chlorid of sodium was eliminated with ease in acute diseases of the kidney, he has shown that it is not the case, and that there is marked retention of salt in the blood.

This being the fact, it is necessary that the diet be as salt-free as possible.

He also demonstrated that while the diuretics of the digitalis group, squills, and nitrate of potash do not increase the power of the kidneys to eliminate salt, most of the theobromin and caffein groups increase this power greatly, and that with increased elimination of water there is a corresponding increase in the elimination of salt.

If fluid collects in the serous cavities and causes distress, it should be removed by aspiration. The subsidence of marked general dropsy should be carefully watched, for frequently at this point acute uremic symptoms occur, due to absorption with the edematous fluid of the toxic substances it contained. If such symptoms occur, all collection of fluid in serous cavities should be aspirated, and if limbs are markedly edematous, they should be drained by puncture.

If the edema cannot be controlled by sweating and purgation and becomes excessive, it may be removed by puncturing the legs, under antiseptic precautions.

Gastro-intestinal Symptoms.—Persistent vomiting is one of the most troublesome symptoms of acute nephritis. Frequently during the course of infectious diseases it is one of the earliest symptoms of kidney involvement. In acute disease of the kidneys it is often due to overfeeding, or to the use of medicines that have been given to influence the kidney function. When present, it calls for modification of the diet, in either amount or kind. The articles of food should be given hot or cold, according as they agree best with the patient.

Persistent vomiting is often best relieved by absolutely abstaining from food for a longer or shorter time. There is too great hesitation about withholding food from acute nephritic cases, for fear they might become weak. Also there is too great a tendency to give medication for this and other symptoms, and the fact is lost sight of that no good is accomplished and no favorable results obtained from any form of medication or of diet restriction, if it is immediately rejected by the stomach.

When vomiting is persistent, a number of drugs have been advocated for its relief: tincture of iodin, 1 drop every half-hour; creasote or carbolic acid in small doses, frequently repeated; tincture of aconite, 1 minim every hour for four or five days; cocain in small doses.

All these drugs fail in the majority of cases, and are tried merely as a last resort. Many of them cause an increase in the amount of gastric disturbance. Creasote should be specially avoided, as it tends to induce cerebral symptoms, independent of uremia, causing the patient to be extremely nervous, sleepless, and at times delirious.

Poultices, ice-bags, or counterirritants to the epigastrium sometimes give relief. Rectal irrigation or injection into the rectum of a small quantity (ʒiv to ʒvj) of saline solution with spiritus ætheris compositus (ʒij to ʒiv) will frequently act as a gastric sedative.

It must not be forgotten that vomiting is frequently a symptom of an impending uremic condition. On the whole, nausea and vomiting should be considered as an indication of the severity of the toxemia, rather than as an independent gastric complication.

To Control Cerebral Symptoms.—The most common cerebral symptoms are restlessness, headache, sleeplessness, and in some convulsions and coma. These symptoms are due to the toxemia, and are best controlled by proper diet and stimulation of the eliminative functions of the skin and bowels. Frequently they demand special treatment.

To control the increased irritability of the nervous system the bromids are indicated. Of these salts, the strontium bromid is the best. As all the bromid salts when administered freely increase the saline content of the blood, they cause more or less irritation of the kidneys. The strontium salts are the least irritating, and in the normal kidney have marked diuretic power. They also have the advantage of not disturbing the stomach. They can be given in 15- to 30-grain doses, and frequently repeated.

The chloral group includes chloral hydrate, sulphonal, trional, veronal, and paraldehyd. The action of these drugs is practically identical, in that they allay the irritability of the nervous system and induce sleep. Sulphonal, on account of its difficult absorption and the uncertainty of its action, is not advised when there is marked gastro-intestinal disturbance. Trional and veronal are more rapidly absorbed and the effects are more certain. Paraldehyd is a perfectly safe hypnotic, but it gives a disagreeable odor to the breath.

Chloral hydrate, in addition to its action on the nervous system, affects the circulation, causing a marked reduction in blood-pressure. When the nervous symptoms of acute nephritis are due in part to high blood-pressure, as well as to irritability of the nervous system, the use of chloral hydrate, 5 to 7½ grains three times a day, is of great value. When there is much gastric irritability, chloral hydrate should not be used.

Hyoscin is recommended when there is more or less delirium and marked restlessness. It should be given with great caution. Cannabis indica has been recommended when there is much hematuria, but it is uncertain in its action and has probably no effect on the hematuria. Aconite frequently controls the nervous symptoms when they are due to high blood-pressure and overacting heart, through its action as a cardiac sedative.

Opium and its alkaloids should be used with caution on account of the nausea and vomiting they may induce, and also the tendency which some claim they have of inducing uremia. The use of opium for the control of nervous symptoms has been considered under "Uremia."

Control of Albuminuria and Hematuria.—During the acute course of the disease the amount of albuminuria and hematuria is a fair indication of the severity and the fluctuations which mark the changes in the pathologic condition. After convalescence has been established, as shown by the amelioration or disappearance of most of the other symptoms, persistent albuminuria does not indicate that there are progressive pathologic changes going on in the different structures of the kidney, but that the epithelium lining the glomeruli has not returned to an absolutely normal condition, and that the control of the epithelium of the glomeruli over the albumin of the blood has not been restored.

Undue importance, from diagnostic and therapeutic standpoints, has been given to the presence of albumin in the urine during the convalescence from acute nephritis and in the chronic types of kidney disease. It is not an index of the nature or severity of the lesions present, nor is it a guide for treatment, either dietetic or medicinal. The total amount lost in the urine is generally small and can be readily replaced by increasing the protein portion of the diet. Attempt to decrease the percentage of albumin in the urine by cutting down the amount of protein in the food has very little effect; while the imperfect nutrition of the patient caused by such restriction has an unfavorable effect not only on the kidney, but also on the organism as a whole. An exclusive milk diet does not control it, although this diet has been advocated most strongly for this very purpose. (See "Chronic Nephritis.")

Its energetic treatment by drugs is wrong. The astringent salts of iron in large doses have been advocated. They have no direct action on the kidney, but frequently some of the less astringent and more easily absorbed forms cause a diminution in the amount of albuminuria by improving the condition of the blood and the nutrition of blood-vessels. Tannic and gallic acids are useless. Some authors report good results from the use of ergot, either alone or combined with digitalis or strophanthus.

The strontium salts, especially the lactate, in doses of 25 to 50 grains, have been used and good results claimed. When strontium lactate influences the amount of albumin, the effect is only temporary, and when discontinued, albumin returns as before its use.

The amount of albumin is influenced by errors in diet, gastro-intestinal disturbances, chilling of the surface, and prolonged physical or mental strain. All these factors should be avoided, as they tend to cause an exacerbation of the nephritis.

During convalescence the patient must be kept under careful observation. He should remain in bed until the acute symptoms have subsided. With continued improvement the patient may be allowed to be out of bed, but the effect of change from the recumbent posture on the urine and the general condition should be noted. Usually there is some slight increase in the amount of albumin in the urine. This is not a good guide, however, as to whether the patient should be kept in bed for a longer period of time or not. A better indication is the effect upon the heart and the quantity of urine. If the heart-beat becomes more frequent and the amount of urine fails, then the patient should be kept in bed for a time longer. If the patient is allowed to be out of bed, comparative rest is necessary for some time.

The patient should avoid the usual morning tub-bath. Usually the fear of chilling from any kind of bath is so great that the patient is not perfectly bathed. Even if all edema and symptoms of uremia have disappeared, an occasional hot-air or Turkish bath is beneficial. When the patient can afford it, a removal to a dry, warm climate should be advised, as it allows the patient a freer outdoor life without the danger of being chilled from sudden changes in temperature.

For a considerable period after seeming perfect recovery the patient's bowels should receive especial attention. Constipation should be avoided and an occasional dose of mercurial purgative should be given. If there is a tendency to constipation, a morning saline laxative, as sulphate of magnesia, or one of the aperient mineral waters, should be given to insure a satisfactory movement of the bowels; but it should not exceed this, for when the medicine causes two or three movements, it is apt to increase the anemic condition. Usually during the acute stage of the disease the patient has been on a very restricted diet. In convalescence there is need of increased nutrition, but the diet should be very gradually increased, especially in the proteid portion. The deficiency in this part may be made up by giving cereals and fat, especially in the form of cream. As soon as it is safe the patient should return to a general mixed diet, as improved general nutrition is necessary for restoration of the kidney. If increase in the diet causes gastro-intestinal disturbance, headache, etc., the diet should again be restricted temporarily, and attention given to the condition of the gastro-intestinal tract. All alcohol and those articles of food that are known to be irritating to the kidney should be absolutely avoided. Excessive drinking of water, either plain or saline, for the purpose of flushing the kidney should also be avoided.

As anemia is generally present, the preparations of iron are indicated. These should be the milder preparations: Basham's mixture, 2 to 4 drams; tinctura ferri chloridi, 5 to 10 minims; or one of the inorganic preparations. During the administration of iron, constipation should be prevented.

From time to time certain drugs have been advocated to aid in the restoration of the kidney and the removal of the inflammatory products. It is extremely doubtful whether it is possible to act on the kidneys by the use of arsenic or of preparations of mercury and the iodids. If these drugs are used, they should be given in small amounts, as they have the power of causing kidney irritation when given in full therapeutic doses. As in most cases of acute nephritis there is the tendency toward recovery after the subsidence of the acute symptoms, our chief care should be to place the patient in the most favorable condition for recovery, rather than actively to treat the kidney by diuretics. The long-continued use of diuretic mixtures containing digitalis, salts of potash, or iron is deleterious.

CHRONIC PARENCHYMATOUS NEPHRITIS

(Synonyms: Chronic Bright's Disease; Glomerulonephritis; Large White Kidney; Chronic Diffuse Nephritis; Chronic Desquamative Nephritis; Chronic Epithelial Nephritis; Chronic Catarrhal Nephritis, etc.)

The above names have been given to this type of nephritis to indicate more or less definitely the nature of the morbid processes. While the renal epithelium is generally extensively involved, the other structures of the kidney, the glomeruli and the stroma, are also affected. According to the changes in the kidney structures, three types of chronic parenchymatous nephritis are pathologically distinguished: (1) The large white kidney, in which the morbid process chiefly affects the epithelium. (2) The small white kidney, where, with the changes present in the epithelium, there has been a gradual increase in the interstitial tissue and secondary contraction. The small white kidney may be a late stage of the large white kidney or may be a primary condition. The interstitial and the epithelial changes run parallel. (3) The chronic hemorrhagic type, while rare, may occur. In this type, in addition to the ordinary transudation from the blood-vessels, there is also a passage of blood through the glomeruli.

The diagnostic symptoms of chronic parenchymatous nephritis are chief urinary changes. The quantity of urine is reduced in the earlier stages, may fall to 10 to 20 ounces, but anuria is rarely present. As the case becomes more advanced the amount may rise to 40 ounces, but as long as the type is characteristic the urine is below the normal amount. When the interstitial tissue of the kidney is markedly increased, and the disease has become more of the interstitial than of the parenchymatous type, the amount of urine is raised beyond the normal. The specific gravity in the early stages corresponds to the small amount of urine passed. It may be high—1020 to 1025. The gradually lowering specific gravity of the urine indicates passage to the cirrhotic type, although before such an opinion is given from the amount and gravity of the urine it is necessary to know whether or not the patient is drinking an inordinate amount of water, as in many cases with supposed kidney disease the individuals drink a large amount of water and restrict the diet, so that there is abundant flow of urine and low specific gravity with normal kidneys. Later, specific gravity falls to 1008 to 1010. The color is turbid, yellow, smoky, with a free deposit of urates. Urea is diminished in proportion to the degeneration of the renal epithelium. Albumin is abundant, 1 per cent. to 3 per cent., or one-half to seven-eighths by the volume, varying from time to time. Microscopically, the urine shows casts of all kinds. The most distinctive cast is the dark granular. In the early stages the urine may contain epithelial and fatty casts and some blood-casts. There are also leukocytes and free epithelial cells from the pelvis of the kidney and the renal tubules.

The amount of urea, while a measure of kidney efficiency, must be taken in connection with the character of the diet, as Chittenden has shown that by reducing the amount of proteid in the food, it is possible to reduce the amount of urea also.

In parenchymatous nephritis dropsy is marked and obstinate; the face and eyelids are especially affected. The patient has a pasty, waxy pallor, which gives him a distinctive appearance, and which is due in part to the anemia and in part to the subcutaneous edema. The circulatory disturbances are marked, the patient's pulse is of high tension, the left ventricle is hypertrophied, and the aortic second sound is increased, and later there is thickening of the blood-vessels. Whether or not the cardiovascular changes are secondary to the renal insufficiency and the accumulation of toxic material in the blood, or whether the renal affection and the cardiovascular are due to the same cause acting simultaneously on the two systems, is still a matter of dispute.

In proportion to the degree of toxemia, there is anemia and marked muscular debility. Gastro-intestinal symptoms are present, as nausea, vomiting, diarrhea. While the amount of urea is markedly decreased, uremia is not as common a symptom in chronic parenchymatous nephritis as in severe types of acute nephritis or in the chronic interstitial type. The course of the disease varies in individual cases, and it is necessary, both for the purpose of prognosis and treatment, to have a clear idea of the types that may occur. Delafield gives the following characteristics of the more common types:

Mild cases: In these there is a small amount of albumin, few casts. The quantity of urine, the specific gravity, and urea are within normal bounds. Cardiovascular changes are absent. The tension in the blood-vessels is not raised; neither headache nor dyspnea is present to any marked degree. There is no loss of nutrition unless the patient has been put on too rigid a diet. These are cases of true nephritis, and not functional albuminuria, as is frequently supposed. The prognosis is good. Some of these patients are overtreated and made needlessly ill, while in others all protective therapy is ignored, as the cases are diagnosed as functional albuminuria. These cases do best on a varied diet, kept within bounds of the kidney power. Plenty of fresh air and exercise should be taken, and no drugs should be given except such as are needed to correct the digestion.

The second type comprises patients in whom the symptoms are nearly continuous. Illness begins with anemia, headache, disturbances of digestion, and slight edema. All these symptoms are at first mild; the patient is able to be up and about, and does not complain of being very sick, but the urine contains large quantities of albumin. The symptoms grow progressively worse. Anemia becomes more marked, headache and disturbances of digestion become more persistent. The dropsy and edema increase in amount until the patient has a general edema, with filling of the serous cavities, and becomes practically helpless. He has attacks of acute uremia with contractions of the arteries. The ordinary duration of this form of the disease is from one to three years. The patients die from extreme dropsy or chronic uremia, or both conditions may be present.

The third type includes cases in which the symptoms are intermittent. During the exacerbations, the anemia, dropsy, and dyspnea are marked, lasting for weeks or months. Between these attacks the patient seemingly recovers, or improves to such a degree that he may be able to work, although the urinary symptoms continue, especially the amount of albumin. The patient's attacks are more apt to occur in the winter, and he is better during the warm months. The attacks become more frequent and each succeeding one more severe; finally an attack occurs in which the patient dies.

Fourth type: In cases of this type the disease started with all the symptoms of acute or subacute nephritis, with anemia, dyspnea, dropsy, albumin, casts in the urine, and more or less intense uremic symptoms. From this attack the patient may make an apparently complete recovery. The urine is at times free from albumin, but usually contains a small amount. From year to year the specific gravity slowly falls and the albumin becomes less in amount and occurs less often. The case gradually assumes the type of chronic interstitial nephritis, but finally, after exposure or following an accident, acute infectious disease, and frequently without any discoverable cause, all the symptoms of a subacute nephritis develop and the patient dies.

Fifth type: In this type there comes on a gradual marked anemia, more or less progressive, with marked pallor of the skin and mucous membranes. These cases are often mistaken for progressive pernicious anemia; the urine is of low specific gravity and usually contains a moderate amount of albumin. The patient may live for a long time. The prognosis depends upon the specific gravity of the urine; if it is persistently below 1010, the prognosis is bad, although the other symptoms of the patient may not be alarming.

Sixth type—the dyspneic cases: In these the first symptom is an attack of spasmodic dyspnea followed by other renal symptoms, or the renal symptoms may be very slight and the dyspnea readily controlled, but the patient has repeated attacks, which become more and more severe, and ultimately other renal symptoms appear.

Seventh type—the cardiac type: In these cases endocarditis, myocarditis, and dilated heart are early prominent symptoms. Unless the history of the case is well known, it is difficult to determine which is the primary lesion.

Eighth type: The eighth type comprises cases in which, after more or less marked kidney symptoms, improvement occurs, with seemingly perfect recovery; patients do not develop any subsequent manifestations of kidney involvement. In this class of cases enough kidney substance has evidently been retained to carry on the function of the organ.

Treatment of Chronic Parenchymatous Nephritis.—Prophylaxis is possible only to a limited degree. In most of the cases a permanent damage has been done to the kidney before the patient is seen. In a small number in which there has been a primary acute nephritis there is an intermediate stage between this and the chronic condition, in which recovery often takes place. If these cases are seen early, or are under continuous treatment from the time of the acute attack, protective therapy may so modify the work of the kidney as to minimize the amount of damage.

Treatment of the Pathologic Condition.—At the present time we have no definite knowledge of the nature of the poison or poisons which cause many of the cases, nor any direct means of counteracting its effects upon the kidney structure. Our knowledge of the pathogenesis of the changes in the kidney is so incomplete that it is impossible to treat the changes in the uriniferous tubules. Various plans of treatment have been proposed to affect the pathologic changes.

As the changes in the renal epithelium are associated to a greater or less degree with increase in the interstitial tissue, those drugs have been recommended which have the power of influencing the development of the interstitial tissue, the iodids and mercurials especially.

Iodid of potash has many advocates, and the claim has been made that under its use the process in some cases has been arrested. Calomel in small doses has also been given for this purpose. Tyson believes it does harm by depleting the individual, and that, as a curative plan of treatment, it is absolutely contraindicated.

Eucalyptus, tannic and gallic acid, fuchsin, and rosanilin have also been administered on account of their supposed action on the renal epithelium or because of their power to control the albuminuria. When chronic nephritis is secondary to syphilis, malaria, or suppurative processes, the treatment directed to the primary disease may be of some use, but unless there is well-marked connection between the kidney changes and other diseases, a specific curative plan of treatment is not without danger, on account of the injury to the kidney by the drugs given.

Although we have no definite knowledge of the poison that induces primary nephritis, or of the causes that lead up to it, every case should be examined carefully for contributing factors, especially errors of diet, habits of life, previous diseases, or medication that has been taken for a long time for some other condition, and which may have influenced the kidney through its elimination.

The management and treatment of chronic parenchymatous nephritis must be varied: (1) According to the severity of the nephritis; (2) the active or passive character of the nephritis at different times, and (3) the presence or absence of certain symptoms, as anemia, edema, nervous symptoms, etc.

In mild cases with few symptoms and with a slight amount of albuminuria and few casts, the diagnosis of nephritis in the early stage is made and energetic treatment instituted. Much harm is done by this plan, as these cases do best with very little treatment. The chief object should be to bring the demands made upon the kidney within the power of the organ, and to avoid direct irritation of the kidney. Acute exacerbation occurring in a chronic case calls for active treatment, as was outlined under "Acute Nephritis."

In the acutely inflamed kidney and the chronically crippled kidney protective therapy, as in diseases of other organs of the body, calls for the limiting of the demands made upon them. As the greater part of the products of metabolism are excreted by the kidney, one of the most important problems in the treatment of kidney disease is how to reduce to a minimum the metabolic products that are thrown off by the kidney, and to avoid all those substances that are excreted with difficulty by the diseased organs.

All writers have insisted on the protection of the kidney by modifying the diet, but there is great diversity of opinion as to how this can be accomplished, and at the same time a sufficient amount of food (calories) supplied to the patient to keep up nutrition. Following the French school, the exclusive milk diet has been the orthodox food in the treatment of acute and chronic renal diseases. This diet has been modified more or less according to circumstances, but the one object was that milk or milk products should constitute the bulk of the food. It has been claimed of an exclusive milk diet: (1) That it is more easily digested and absorbed than any other article of food; (2) that milk does not irritate the kidney; (3) that it is diuretic; (4) that it is free from toxic substances, and that its end-products are not irritating; (5) that for the amount of proteid contained the quantity of urea excreted by the kidney is less than any other kind; (6) that it diminishes the amount of albumin.

While the prevalent opinion is that milk or milk products should form the major part, at least, of the diet of acute renal disease, and that it is a sufficient and the best diet for cases of chronic renal insufficiency, this conclusion is not as generally accepted as formerly, for the following reasons: As to the ease with which milk is digested and absorbed, in many instances it is not well borne, the digestive tract is disturbed, the patient complains of tympanites, and the bowels are either constipated or the patients have attacks of diarrhea; there are other symptoms of gastro-intestinal disturbance, as nausea, headache, fatigue, which group of symptoms is described by the patient as "biliousness." The digestibility and degree of absorption have been largely judged by the amount of urea secreted. In cases where urea output was small, it was claimed that the proteid was converted in a different manner than the proteid content in other articles of diet, which is a physiologic impossibility.

In cases of low urea output, on an exclusive milk diet, the major part of the casein was undigested and passed in the feces. That milk does not irritate the kidney as much as other foods is true to a certain degree only; if all the proteid contained in the milk was digested and absorbed, the same quantity of urea would be formed as from a like amount of proteid taken in other forms. The advantage of the proteid of the milk is that it is a simpler combination than most other articles of diet. In meat it is the extractives that add to the kidney irritation and stimulation. The amount of proteid contained in 4 to 5 quarts of milk is usually much greater than the patient demands.

The diuretic action of milk has been doubted and its harmlessness questioned in acute diseases of the kidney and in the parenchymatous type of chronic nephritis. As will be considered more fully later, water is eliminated with more or less difficulty according to the severity and extent of the kidney lesion. The amount of water contained in the quantity of milk necessary to keep up nutrition is excessive, for the kidney cannot excrete it with ease. If diuresis is not induced by the quantity of water taken as milk, a condition of plethoric hydremia results, with danger of edema and also damage to the cardiovascular system.

That milk diminishes the albuminuria is not true in all cases, and even if true, is not of great importance in chronic cases. Too much importance is paid to the fluctuation of the amount of albumin, especially in chronic cases, and while the amount of albuminuria may be an indication of the severity and course of the disease in acute cases, it has very little significance in chronic cases.

A proper diet must contain quantitatively and qualitatively all that is needed to maintain the general nutrition of the patient. Exclusive milk diet does not meet this requirement; it contains too much proteid, too little carbohydrates, and too much phosphorus, while it is deficient in iron.

Widal claims that the benefit derived from milk diet in the parenchymatous type of nephritis is due to the small percentage of salt that it contains. He has shown that in diseased conditions of the kidney, especially those types associated with edema, the power of the kidney to eliminate salt is deficient, causing an accumulation of this substance in the blood and tissues, and that edema is due to this retention. Experiments have shown that in nephritis with edema, by increasing or diminishing the amount of salt in the food relative to the quantity eliminated by the kidneys, it is possible to influence the weight of the patient and the presence of edema at will. Widal claims that in many cases of disease of the kidney it is not the proteid that causes fluctuation in the amount of edema, and also of albuminuria, but the quantity of salt. By placing the patient on a salt-free diet it is possible to influence the amount of edema independent of the character of the food taken. Cases of nephritis with a tendency to dropsy should be carefully watched in regard to the intake of salt. The power of salt to increase edema has an important bearing on the giving of saline waters in the treatment of different forms of nephritis.

It has been found practically impossible to continue for any length of time an exclusive milk diet, as patients become tired of it. It is impossible for them to take the amount necessary to keep up nutrition. Skimmed milk and buttermilk diet in chronic parenchymatous nephritis has been frequently advised. Many patients can drink larger quantities of milk in this form than of pure milk, but it lacks the nutritive value, and an excessive amount of fluid has to be taken. Fermented milk products, such as kumiss, kephir, etc., have been often advised as an exclusive diet in chronic parenchymatous nephritis. It must be remembered that they contain alcohol. In cases of chronic nephritis where 6 to 8 pints of kephir and kumiss are taken, the amount of alcohol contained in this quantity equals 3 to 4 ounces of brandy, a quart of moderately heavy Burgundy or Rhine wine, a quart and a half to two quarts of beer. The increase of diuresis that frequently follows the use of kumiss is undoubtedly due in many cases to the presence of the alcohol.

Although an exclusively milk diet is no longer insisted upon in chronic parenchymatous nephritis, what articles of food should be specially prohibited, how much proteid, carbohydrate, and fat should be given, is still a much-disputed question. As a rule, patients with chronic parenchymatous nephritis are allowed a more liberal diet than formerly, and only those things are forbidden which are known to have an irritating effect on the kidneys.

The diet should be abundant, highly nutritious, of good quality generally, but not excessively nitrogenous. The necessary calories should be made up from the carbohydrates and fatty foods, while those containing proteid should be reduced to the minimum amount. The attempt to reduce the amount of albumin lost through the urine by diminishing the amount of albumin taken as food is not without danger, for frequently the extreme weakness present in nephritis is due to improper nutrition, and while the amount of albumin may be slightly controlled, the diminished intake does not make good the loss or give a sufficient amount for general nutrition. It is frequently necessary to make up the albumin lost through the urine by increasing the amount taken in the food. Both extremes are bad, and the routine treatment of all cases in this regard is to be condemned.

In most cases the determination of the amount of albuminous food that the patient needs is a matter of observation. If under a fairly free diet the patient's general condition improves and no unfavorable symptoms develop, even if the amount of albumin lost by the kidneys is increased, the diet is suitable. When the loss of albumin is increased, however, and there are also dyspnea, headache, general discomfort, and other symptoms of toxemia, then the amount of proteid food must be diminished. After the above symptoms have disappeared, if there is evidence that the patient is not sufficiently nourished, the diet should be gradually increased in proteid by giving meat, eggs, fish, etc. It must be remembered that the patient's tolerance of proteid food varies from time to time, and the diet must be changed accordingly. Unrestricted or exclusive milk diet should be limited entirely to acute exacerbations of chronic nephritis or to hematuria. On account of the interference with the digestive organs, the food should be given often and in small quantities.

It cannot be too strongly insisted upon that each case should be studied individually, and that attention should not be centered too closely upon the urine. The patient should be treated, not the albuminuria.

The use of alcohol in these cases should be absolutely forbidden, except under special circumstances. It is necessary to be guided by the condition of the patient and his general habits. In patients who have been accustomed to take stimulants, it is often impossible to enforce total abstinence, as it may cause loss of appetite and inability to digest what food is taken. Frequently also with the withdrawal of the alcohol the amount of urine rapidly diminishes and the patient becomes profoundly depressed. A small quantity of alcohol well diluted with water, taken at meal-time, enables him to take more nourishment, to digest it more perfectly, and improves his general condition.

The form of alcohol that is allowed will also depend upon the individual case. There is great difference of opinion as to the merits of the different forms on the part of the various writers; some allow light wines or beers and forbid all concentrated forms; others forbid all the lighter forms and give whisky only.

The most important thing in determining the kind of alcohol to be used is the amount of alcohol to be given, and whether or not other ingredients in the beverage besides the alcohol are going to influence the kidney function, and also which form is going to be relished by the patient. Many fear that a small amount of alcohol will damage the kidney, and yet have no hesitancy in prescribing tonic drugs, gastric stimulants, and even diuretic drugs that are many times more irritating.

In many cases diuresis has so long been carried on under the influence of some special form of alcoholic beverage that it is necessary to continue its use in order to obtain an adequate flow of urine. If the patient has never been accustomed to stimulants, there is no need of giving them unless some special conditions call for their use, as cardiac weakness.

The diminution in the urine and its relation to dropsy and uremic symptoms would often seem to indicate that some treatment should be directed to the kidneys to increase the watery flow. When the diminution in the urine is dependent upon an acute exacerbation of nephritis, it should be treated as indicated under "Acute Nephritis." In the more chronic conditions it is necessary to determine the cause of the diminution.

In cases without dropsy the free use of liquids may stimulate the renal function without irritation. If there are marked interference with the urinary flow and tendency for edema to occur, however, then the giving of large amounts of fluid will only embarrass the circulation and cause an increase in the edema.

The deleterious effect of the increase of fluids when they fail to stimulate kidney function is shown by an increase in the weight of the patient, due to retention of fluid in the blood-vessels, even before there is any increase in the amount of edema.

Digitalis will give relief when diminution of the urinary secretion is due to obstruction in the kidney circulation, especially in the capillaries of the glomeruli. By raising the general blood-pressure the circulation of the kidney may be increased, and both the amount of urine increased and the other symptoms diminished; but if it fails to increase the amount of urine, it should be stopped, as cumulative effect and circulatory disturbances are rapidly induced.

Digitalis may be given in the form of powdered leaves, gr. j; infusion, ʒij to ʒiv; tincture, ♏v to x; or fluidextract, ♏j to iij, three or four times a day. Whatever preparation of digitalis is used, rather small doses should be administered at first and gradually increased.

The diuretic action of digitalis is slowly produced, and often only after three or four days. For this reason it is necessary to continue its use for some days, and the dose must be correspondingly small, so as to avoid toxic effects.

In many cases tincture of strophanthus, 5 to 10 minims three times a day, acts better than digitalis. Squills has also a digitalis-like action on the cardiovascular system, but, in addition, has a more stimulating and slightly irritating action on the kidneys.

The combining of the different members of the digitalis group together, or with some preparation of mercury, is frequently more effective than their use singly. When combined with calomel, there is danger of salivation, which accidental effect at times occurs after a few doses only have been given.

The compounds of caffein, theobromin, and the synthetic product called theocin are extensively used as diuretics in chronic parenchymatous nephritis. The study of the chemical relation of these preparations to the xanthin or uric acid group has led to the belief that they do not cause renal irritation, that they act as direct stimulants upon the renal epithelium, and that they can be used with safety in all cases where the urine is deficient. While they do not cause any irritation to the normal kidney, in the acutely inflamed organ, whether of primary acute nephritis or acute exacerbation in chronic nephritis, they have a tendency to increase the pathologic hyperemia. In acute conditions their use should be limited to those cases in which there is imperative need of elimination through the kidney, regardless of any injury that might be produced. In chronic parenchymatous nephritis, and especially when there is loss of cardiovascular compensation, the use of these preparations is without danger, and often very efficacious.

The dosage of some of these compounds is as follows: Diuretin (sodium theobromin salicylate), dose 15 gr. in capsules or in solution (80 to 120 gr. a day); agurin (acetate of theobromin sodium), dose 7½ to 10 gr. (45 to 80 gr. a day); theophyllin sodium (Boehringer) or acetate of theobromin sodium (Bayer), 5 to 7½ gr. four to six times a day.

The diuretic action of these preparations is more readily obtained when there has first been a free relief of the venous congestion and reduction of the edema by purgation and hot packs. The observations of Widal and Javal show that these drugs increase not only the watery part of the urine, but also the solids, especially sodium chlorid and urea.

The use of diuretic infusions and teas is often followed by increased diuresis. The most important of these infusions are the decoction of broom tops (scoparius), ½ ounce in a pint and a half of water, boiled down to a pint—2 ounces of the infusion given at frequent intervals during the day, the whole amount being taken in twenty-four hours; triticum repens (couch-grass), 1 ounce to a pint and a half of water, prepared in the same way and administered as the broom tops; juniper, 1 ounce of the berries steeped in a pint of boiling water for an hour, the whole strained, and the liquid given in divided doses during the twenty-four hours. Generally cream of tartar or one of the alkaline diuretics is added to the infusion of juniper.

The administration of the stimulating diuretics, infusions, and decoctions in chronic parenchymatous nephritis should be limited to cases in which there are no symptoms of acute inflammation. The alkaline diuretics have been advocated in chronic parenchymatous nephritis for the same reason as in acute nephritis. Their influence is chiefly upon the coagulability of the albumin, and they have very little diuretic effect, although it has become almost a routine practice to give one of the alkaline diuretics in every case in which an examination of the urine shows any evidence of nephritis.

Albuminuria does not call for any special plan of treatment, and while in acute nephritis it may be taken as an indication of the severity of the disease, the same does not hold good in the chronic types. It merely shows that the renal epithelium is disturbed and allows the free passage of serum-albumin from the blood-vessels into the uriniferous tubules. The effect of diet and alcohol upon the albuminuria has already been considered. The use of drugs for the control of the albuminuria is based more upon theoretic grounds than on any definite knowledge. Rest in bed frequently diminishes it, as in many cases the amount of albumin in the urine depends on the amount of exercise the patient is taking, corresponding in this respect to the so-called "postural albuminuria." The routine practice of confining the patient to bed merely to diminish the amount of albuminuria is wrong, as the patient rapidly loses strength, the appetite fails, the bowels become sluggish, and there is a general deterioration of health. Many cases have been in fair health, able to attend to their business, and were in fact unconscious that they were suffering from any chronic form of kidney disease until albumin was found in their urine and they were put to bed, their diet restricted, and treatment directed to control the albuminuria.

The astringents, especially the remote astringents which act by constricting the blood-vessels during their elimination, are not without danger because of a certain amount of irritation to the kidney epithelium. While diminishing the amount of albumin, they may also interfere with the elimination of other material by the kidneys. When given in large quantities, they cause disturbance of the stomach and bowels.

Acetate of lead cannot be given for any length of time without digestive disturbance. It is of doubtful value in both albuminuria and hematuria.

Iron has been used extensively, both as an astringent and as a tonic. The astringent salts and preparations are of doubtful value for diminishing the albuminuria and hematuria. Whatever effect is obtained from iron is due rather to its action upon the blood-making processes and general nutrition than to any direct action on the kidneys. Anything that increases the nutritive power of the blood will decrease the degenerative tendency in the diseased organs. The routine administration of iron is often harmful. It should be given with judgment, and only in sufficient doses to counteract the anemia. Basham's mixture and the tincture of chlorid of iron are the most useful preparations, although lately preparations of inorganic iron have been largely used.

Ergot in some cases has given seemingly good results in controlling hematuria. It has no influence, however, over albuminuria. Tannic and gallic acid, fuchsin, and benzoic acid have all been recommended, but are of doubtful value.

The Treatment of Dropsy.—On account of the danger of excessive dropsy, special treatment is often demanded for its relief. While it gives much discomfort and attracts the greatest amount of attention, it is only in extreme cases that any danger results from it. Rest in bed and warmth, together with alteration in the amount of diet, especially the liquids, are frequently sufficient to control it. Withdrawal of fluid from the body through the skin by diaphoresis will often relieve the accumulation in the tissues. Diaphoresis by baths, packs, etc., has already been considered, also the need of controlling the amount of water taken at the time of diaphoresis. (See "Acute Nephritis" also.)

The use of the medicinal diaphoretics, such as pilocarpin, while producing free sweating, is not without danger. This drug may affect the heart, causing weakness and collapse. The action upon the salivary glands may cause distress, and in unconscious patients become a dangerous condition on account of the tendency of the saliva to choke the patient. When pilocarpin does not act freely upon the skin, it may cause free secretion into the stomach, producing excessive nausea and vomiting. The same excessive secretion may occur in the bronchi. It should be used only when there is no cardiac weakness or pulmonary complication. The giving of small doses, just sufficient to cause a mild stimulating action on the skin, often increases the efficiency of the hot baths. Other contraindications to the use of pilocarpin for free diaphoresis are the evidence of edema of the posterior portions of the lungs, and of effusion into one or both pleural sacs, and of emphysema with dilated right ventricle.

The reduction of dropsy by the use of purgatives can be employed for short periods only, and their continued use is bad, as they disturb the intestines, and by the rapid removal of the partly digested foods, together with the albumin which passes into the intestine with the fluid, cause weakness from defective nutrition. Given for a short time, purgatives are of value in relieving the venous congestion, and so relieving the pressure on the kidneys.

The selection of the cathartic is important. The drug must not disturb the gastro-intestinal tract, nor must it add anything to the blood that is to be eliminated by the kidneys and cause irritation. The simple laxatives are of very little use. The saline purgatives, when used, should be given in concentrated form, so as to influence as profoundly as possible the watery content of the body.

Jalap in various preparations is most satisfactory; it may be combined with mercury or with small quantities of scammony. The compound jalap powder has been given daily for weeks at a time without producing marked intestinal disturbance or depleting the patient.

Small doses of elaterium (gr. $\frac{1}{8}$ to $\frac{1}{4}$) or elaterin (gr. $\frac{1}{10}$), two or more times a day, to cause three or four watery movements, not only remove the edema, but diminish many of the symptoms of toxemia. If the drug causes griping, it may be combined with extract of hyoscyamus (gr. $\frac{1}{8}$ to $\frac{1}{4}$).

Diuretics: The digitalis and theobromin groups have already been considered. The use of the alkaline diuretics, as the carbonate and citrate of lithium and citrate and tartrate of potash and soda, has been advised on account of their supposed action in preventing coagulation of the albumin in the tubules, and so preventing diuresis.

Widal has called attention to the influence of sodium chlorid (common salt) in the production of dropsy. This has already been considered on p. 658. The use of the different forms of diuretics, especially of the caffein group, upon the elimination of salt is an important one. The effects of cathartics upon salt elimination are also important. When the stools are well formed, the amount of salt present in them is very small in quantity; when there is diarrhea, however, the amount is markedly increased.

The influence of cathartics is therefore not only the removal of fluids from the body, but also of salt, which tends to hold the fluid in solution in the tissues.

CHRONIC INTERSTITIAL NEPHRITIS

Numerous names have been given to this condition, intended to indicate the appearance of the kidney, to summarize the microscopic and pathologic changes, or to connect certain etiologic factors with the morbid processes. The most important synonyms are: Chronic Bright's disease; cirrhosis of the kidney; chronic indurated kidney; small red granular kidney; arteriosclerotic kidney.

The most marked pathologic changes in this type of renal disease are:

(*a*) In the kidney a chronic inflammation, with an overgrowth of the connective tissue of the stroma, which may be uniform throughout the kidney or may occur in isolated areas. This latter condition accounts for increase in amount of urine associated with fairly normal urea output.

With the growth of connective tissue there are changes in the glomeruli in the affected areas. Some are atrophied from pressure of the surrounding new tissue. Circulation through the capillaries is interfered with, and there is an obstacle to the escape of blood from the renal vessels. The blood-pressure in the remaining Malpighian tufts is raised and diuresis is increased. The arteries of the kidney, both large and small, are thickened, but the caliber of the arteries is not considerably or constantly diminished. The Malpighian bodies withstand the effects of the increase of new connective tissue longer than the tubules. In the tubules there is degeneration of renal epithelium; the lumen of the tubes is in some places narrowed or obliterated, and in others dilated. The contractile growth strangulates the essential structures of the gland.

(*b*) Cardiovascular system: Coincident with the kidney lesion, changes occur in the heart and arteries. The left ventricle of the heart becomes hypertrophied in proportion to the changes in the kidney and the arteries. This condition is so constant as to be considered part and parcel of chronic interstitial nephritis. As long as the power of the heart is equal to the increased demands of the circulation, it compensates for certain changes in the kidney circulation and is necessary for the proper functioning of the kidney. Later in the disease, as the result of nutritional changes, or dependent upon intercurrent damage to the heart, dilatation with myocardial degeneration occurs. Delafield considers the change in the arteries to be chronic arteritis, and that it is as definite a diseased condition as endocarditis, cirrhosis of the liver, or other pathologic changes which may occur with kidney fibrosis. It is not uniform throughout the body, and according to the location and severity of the arterial change, symptoms occur, and it may be the determining cause of the death of the patient.

The characteristics of chronic interstitial nephritis are its insidious onset and its slow course, rarely following an acute attack, and being, as a rule, chronic from the very beginning. In the majority of cases no diagnosis of the condition is made until secondary changes or complications have called the patient's attention to his condition. In some cases, although the urinary examination may show marked impairment of kidney function, the urine may be of low specific gravity and deficient in urea, the left ventricle may be hypertrophied and blood-tension high, still the patient does not complain of ill health. In other cases patients complain of gastro-intestinal disturbance chiefly, and it is only on examination of the urine that the kidney condition is discovered.

In others the cardiovascular symptoms are the most prominent, the patient seeking relief on account of so-called asthmatic attacks, or for dyspnea due to weakening cardiac power. The course and duration of chronic interstitial nephritis are extremely variable.

Many cases with marked urinary disturbance, low specific gravity, and deficient urea survive the condition for years, and die at an advanced age from cerebral hemorrhage, dropsy, or a chronic cachexia. In the majority of cases death occurs from some complication, which complications, in the order of their frequency, are cardiac degeneration, cerebral hemorrhage, dropsy, uremia, acute or chronic cachexia. The course and duration of the disease are influenced chiefly by the age of the patient, his circumstances, occupation, and mode of life, and the stage at which the disease is recognized and the patient submits to the necessary régime. When patients are seen early and are able to follow out instructions, the immediate danger of the disease is not great.

Treatment of Chronic Interstitial Nephritis.—While the disease is incurable and tends to progress, much more can be done than might be expected. By judicious management and appropriate treatment its course may be checked, or at least its progress controlled. The symptoms can be treated, complications prevented, and the strength of the patient maintained so that he can continue his business and enjoy a fairly comfortable existence for years. Because the disease is incurable, a hopeless view of the case is usually taken. So firmly is this idea fixed in the minds of the profession and the laity that a diagnosis of chronic Bright's disease is considered a sufficient excuse for abandoning all hope of life or comfort. The main object of the treatment should be: (1) To control the factors that cause the condition or that may increase the progress of the disease; (2) to reduce to the lowest level compatible with good and sufficient nutrition those products derived from the food which must be excreted by the kidneys and which irritate them, or, being retained in the blood, damage other organs or produce symptoms; (3) to relieve the excretory work of the kidneys by inducing elimination by other organs; (4) to regulate the patient's habits, mode of life, and business cares and worries to those which are compatible with his condition; (5) to guard against the complications or intercurrent diseases which are specially dangerous in patients with chronic interstitial nephritis.

Prophylaxis.—As the specific exciting cause of the interstitial growth in any case is rarely known, and cases of chronic interstitial nephritis are rarely seen early in the disease, prophylaxis is impossible. Generally they do not seek medical advice until some symptoms, as anemia or cardiac or digestive disturbance, are present. The relation that certain conditions and diseases have to the production of cirrhosis of the kidney makes it necessary to prevent these factors from being continuously active in causing irritation of the kidney and favoring interstitial overgrowth. The history of kidney involvement in a previous acute infectious disease should lead us to warn the patient to avoid all likely causes of subsequent kidney irritation and to be on the lookout for the symptoms of any kidney trouble.

Gout and poisoning by lead and alcohol being such common excitants of kidney irritation, every precaution should be taken to prevent further toxemia from these causes, and to minimize their effect on the kidneys when present. A family history of fibrosis, not only of the kidney, but of the lungs and the liver, or of the cardiovascular system, without adequate cause, should make us suspicious of the presence of any symptoms that may occur in the course of chronic nephritis, and if the case is under our care, measures should be taken to avoid all circumstances that may develop this tendency.

Whether or not pregnancy should be allowed to progress when at a previous pregnancy there was kidney complication is a very difficult question to decide, especially if there is no accurate knowledge of what the condition was at that time. If there was merely edema of the lower extremities and slight albuminuria due to pressure on the return renal circulation, and no subsequent evidence of any renal insufficiency, there is no danger. If during the previous pregnancy there was no evidence of any interference with the renal function during its course, but puerperal eclampsia came on suddenly during labor, and there were no subsequent symptoms of kidney disease, the probable cause of the eclampsia was a sudden overwhelming of the nervous system and the kidneys by a large amount of toxins or irritant matter forced into the circulation from the uterine cavity, and the kidney condition was an acute and passing one and no permanent damage was done. When there is evidence of permanent damage to the kidney, pregnancy should be avoided, if possible; and if it occurs, its course should be watched with great care, not merely for the usual urinary changes, but for all symptoms of renal toxemia.

The acute congestion of the kidney which occurs during a malarial paroxysm produces only a transient effect on a normal kidney. If the attacks occur at short intervals and the congestion is extreme, it may start an interstitial overgrowth, or if the kidney is already diseased, it may increase the process. Prudence would cause avoidance of this danger, and if the patient is living in a malarial district, he should move his residence.

Valvular disease of the heart may induce kidney cirrhosis, or in turn may be induced by it. When present, every precaution should be taken to preserve cardiac competency and prevent renal congestion.

Specific treatment or treatment directed to the removal of interstitial overgrowth in the kidney has always been a desideratum. Unfortunately, we have no definite knowledge that it is possible by any method at our disposal to accomplish this. The drugs most frequently used for this purpose are iodid of potash, bichlorid of mercury, and the chlorid of gold and sodium. Many clinicians believe that, although it is impossible to remove cicatricial tissue that has been fully formed, it is possible to prevent its further development by the uses of these remedies. Iodin and the iodid have been used most frequently for this purpose. Bartels advises the use of the iodids

(10 to 30 grains daily). He begins with small doses not exceeding 3 grains and increases very cautiously. He claims that it can be used for an indefinite period, and that while useless for removing interstitial tissue, it is useful in dilating the blood-vessels and acting as a diuretic. He advises that it be given fasting. The best results are obtained when its use is begun in the earlier stages before dropsy, uremia, or defects of vision have made their appearance. He prefers the iodid of sodium to that of potassium. He considers that the bichlorid of mercury does good in some cases and has, at times, the effect of improving the albuminuric retinitis.

Delafield, while doubting the power of the iodid of potassium to modify in any degree the pathologic condition of the kidney, thinks that the iodid produces the good effects that have been noted by affecting the caliber of the blood-vessels.

When these preparations are used for the above purpose, it is necessary that their effects be closely watched. In proportion as the eliminative function of the kidney be affected, there is tendency for these drugs to accumulate and produce toxic symptoms. This is especially true of the bichlorid of mercury.

Diet.—The regulating of the diet is the most important part in the treatment of chronic kidney disease. As the excretory power of the kidney is diminished it is necessary to reduce the nitrogenous products of the urine that are derived from the food. In acute diseases of the kidney this can be accomplished by low and rigid diet of milk and farinaceous foods, but this diet can be continued only for a short time. If continued longer, the patient's nutrition suffers, and in many cases where a too low diet has been continued, convalescence has been delayed and the patient benefited by a more liberal diet. Whenever the diet is reduced beyond a certain point for any length of time, starvation begins, and there is destruction of the proteid elements of the body, and increase from this source of the amount of urea in the urine. In chronic diseases of the kidney the dietetic treatment is most difficult, and the long course of the disease, and the need of keeping up the general health to the highest possible point, demand that the diet be an appropriate one, containing all the elements necessary for general nutrition.

While all clinicians agree that it is necessary to spare the kidney by diminishing the amount of its work, at the present time opinion varies as to how this should be accomplished, and what the dietetic treatment should be.

The exclusive milk diet has been the one most often advocated. This diet has been modified more or less, but the essential feature was that milk or milk products should constitute the bulk of the food. The arguments for and against this rigid milk diet have already been considered under "Chronic Parenchymatous Nephritis." The difficulties in keeping a patient on a rigid milk diet are much greater in chronic interstitial nephritis than in the parenchymatous type, and the wilful departure of patients from the prescribed diet without any detriment, but often with marked improvement, has caused clinicians to allow a more liberal diet, especially in regard to meats and other proteids.

Von Noorden states that on account of the long duration of the disease and the natural craving for variety of food, the restriction of the diet should be as little as possible, and only those things should be prohibited which are known to be irritants to the kidney. Strong meat broths and extracts should be forbidden, as well as all spoiled food-stuffs, and those preparations which contain large amounts of extractives, as sausage, decayed food containing toxins that may produce mild kidney irritation, for the diseased kidney has less resistance to this irritation than the normal. Apart from these products, the choice of foods should not be further limited, and a restriction of the proteids to those derived from milk or white meat only is more theoretic than practical, and in the treatment of atrophic nephritis must be given up.

The hard and fast routine prescription of only white meat, and the absolute avoidance of dark meat as harmful and poisonous, develop such an aversion to white meat that its consumption is reduced to a minimum. As eggs are, as a rule, forbidden or markedly restricted, and as very few people can take large quantities of milk, and as patients are not instructed to substitute vegetable for animal products, the prohibition of dark meats leads to a very poor diet of proteids.

That a very low proteid diet prolonged for months or years exercises a harmful influence upon nephritic patients is shown by the fact that they are weak, delicate, easily tired, and incapable of performing any real muscular work. The intensity of the albuminuria is not to any great extent dependent upon the form in which the proteid is eaten. Von Noorden finds that it is much easier to feed patients in a rational manner, and to raise their general strength, if the diet can be selected so as to include dark meats.

The question of how much proteid, and in particular how much meat, should be allowed patients with contracted kidney is largely a theoretic problem. Von Noorden allows patients with contracted kidney to select the diet themselves from among the articles that are permitted, and to eat as much of each article as they care to. As a result they feel as well for as considerable period of time as can be expected in cases of contracted kidney.

Dickinson* says: "Nitrogenous food should be reduced to the lowest amount compatible with health; having regard to the fact that uremia threatens, on the one side, while anemia is to be feared, on the other. Meat may be given on one day, fish on another, and on the next neither. Every kind of vegetable food is allowed, more particularly the farinaceous. Regard must be had to the individual tastes and suitability. Milk may be freely used, but has not been found as suitable in quiescent cases, as they do not do well on a pure milk diet."

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* Allbutt's "System of Medicine," vol. iv.

West states: "Although it is advisable that the amount of nitrogenous food should not be too great, still it is possible to err on the other side and make it too small. It is impossible to prescribe one dietary which will suit every one. Idiosyncrasy must be considered in every case. Meat extracts should be avoided, as they contain little that is of use and impose a large amount of work on the kidney." "Albumen is best in original form. Have well-cooked meat, fruit, or fish, but in moderate amount. Vegetables and salads are good, but not a strict vegetable diet. Farinaceous foods of every kind are clearly indicated, and milk and cream can be taken in quantities, for such fattening foods tend to counteract the loss of flesh which is one of the tendencies of the disease as it progresses."

W. Hale White writes as follows: "From a dietetic standpoint chronic interstitial nephritis is treated too zealously. In the desire to spare the kidney the patient is starved as regards some classes of food. This is bad, for the renal trouble is largely a degenerative process, and this can only be retarded by keeping the patient as nearly as possible to good health. It will certainly be accelerated if he is almost starved.

"We do not know for certain that any articles of ordinary diet are harmful to a granular kidney, therefore the patient is dieted best who has ordinary plain digestible meals containing a correct amount of proteids, fats, carbohydrates, and salts, much the same as in ordinary diet, and in such quantities that he feels well and keeps his weight about normal. The food should be plain but properly cooked, so that it may be appetizing. Sauces, condiments, etc., should not be allowed, as they are not foods.

"There is no difference in the character of meats, whether from chicken, fish, or beef. Not only are many of the restrictions often placed on diet unnecessary, but they are harmful, for they make the patient a miserable introspective valetudinarian."

Moore believes that nitrogenous food should be used sparingly, but the patient should not suffer the pangs of hunger or waste for want of it. Solid food is relished by many patients, and they improve under its use, as they object strongly to the use of "slops."

Tyson says: "The amount of nitrogenous food should be restricted, but it is not possible or advisable to exclude all nitrogenous food, but it should be reduced to a moderate amount. This can be accomplished by the substitution for all or part of animal flesh milk and cream, while drawing the elements of mixed food from the vegetable kingdom. While a purely vegetable diet may be compatible with life and a fair amount of health, it is not compatible with the highest mental and physical development. But in a contracted kidney it may do more to protect the kidney than any other form of diet."

The diet in chronic interstitial nephritis should be arranged to meet the needs of the individual case. It is impossible to arrange a hard and fast dietary suitable for all cases of nephritis, as every case has its peculiarities, which can be known only after careful observation.

The diet should be varied according to the age of the patient, the social condition, and the time of the year. The diet that is suitable for one stage of the disease would be inappropriate for another. Too frequently patients in the early stage of chronic nephritis are too restricted in diet, with the result that though previously their health was good and they were not conscious of any symptoms, they rapidly lose weight and strength, and begin to suffer from dyspnea, slight edema, and other symptoms of cardiac weakness. This condition is especially induced where patients are put on too rigid a milk diet, or have been encouraged to drink excessively of fluids for the purpose of flushing the kidneys.

In cases in which the patient has a good appetite and does not suffer from any digestive disturbance, and in which he is able to take a sufficient amount of exercise in the open air, a mixed diet containing meat at least once a day is indicated.

In the later stages of the disease, when the patient shows signs of toxemia from imperfect elimination by the kidneys, then only should the diet be restricted. Even in these cases the restriction must not be so marked as to interfere with good nutrition. It is best in these cases, if patients suffer from any of the symptoms that indicate uremia, to restrict the diet markedly for a longer or shorter time; but with the relief of the symptoms to increase the diet gradually up to the point of tolerance, so as to prevent malnutrition.

While at the present time the diet in cases of chronic interstitial nephritis is more liberal than formerly, still great caution must be exercised, not only in the character and amount of the proteids, but also in the use of certain articles of food which may cause kidney irritation. As these patients suffer from loss of appetite, they desire their food to be highly seasoned. Condiments should be used in extreme moderation. Von Noorden claims that certain vegetables are known to produce kidney irritation if taken in large quantities, as celery, lettuce, sorrel, mushrooms, and onions, especially in the raw state. Asparagus has generally been forbidden. On account of the odor that it imparts to the urine, it has been considered as a renal irritant. In moderation it is harmless.

The use of alcohol in the treatment of chronic nephritis depends upon the individual case. When there are no indications for its use, it should be avoided. If the patient is seen early in the disease and gives a family history of nephritis, or shows any indications of cardiovascular changes, even though urinary symptoms are absent, alcohol should be absolutely prohibited. Later in the disease, when the nephritic changes have become chronic, there is less danger in its use. Patients who have become habituated to the use of alcohol, when deprived of it suffer from loss of appetite, and food causes nausea. The giving of small quantities in these cases improves their general nutrition. In the later stages of the disease small quantities of alcohol are also necessary on account of the cardiac condition or attacks of nocturnal dyspnea. There has been a great difference of opinion as to the form in which the alcohol should be given, some claiming that the lighter preparations are the least injurious, while others advise whisky well diluted. In the terminal stages of nephritis the effect of alcohol on the kidney can be ignored, and if the patient is relieved of any of his symptoms by the judicious use of stimulants, they should be given.

Drugs.—Certain drugs are to be avoided in atrophic nephritis. To this class belong cantharides, copaiba, turpentine, salicylic acid, carbolic acid, resorcin, lead, copper, silver, mercury, and other mineral salts, iodoform, and tar preparations. It is necessary to be careful in the use of these drugs in patients with atrophic kidneys, because the disease runs so protracted a course, and so many of the intercurrent diseases are usually treated with some of the above preparations. While some of these drugs have not been proved absolutely injurious to the kidney, many of them are very slowly excreted, especially the iodin salts, antipyrin, methylene-blue, and boric acid. Quinin is also very slowly eliminated, and may be irritating on this account. Iodoform is very apt to set up toxic symptoms when freely absorbed from wounds or given internally.

The Use of Diuretics.—One of the most important indications for treatment in chronic interstitial nephritis is to prevent the accumulation in the blood of the poisonous products of metabolism and tissue waste which are usually excreted by the kidney. The amount of urinary water is increased, and is one of the prominent symptoms, but it is of low specific gravity, due to the diminished amount of the solids. The stimulation of the eliminative function of the kidney by drinking large quantities of water has been more or less a recognized plan of treatment, and as the patients are thirsty, they are willing to follow this course of treatment, and have come to look upon the amount of water passed as an index of their improvement. While the taking of large quantities of water may increase the quantity of the urine, there is no evidence whatever that it increases the elimination of the solid ingredients. On the other hand, it may cause irritation of the kidneys from the excessive amount of water passing through them. If the kidneys do not rid the system of water, it rapidly accumulates in the blood-vessels and produces a condition of plethoric hydremia, and may be the starting-point of cardiac insufficiency and subsequent edema.

Many patients with chronic interstitial nephritis who have sought relief at the spas have had life terminated suddenly by one of the complications induced by drinking water beyond the power of the kidneys to eliminate it. Von Noorden has called attention to the beneficial effect of restricting the amount of fluid taken in cases of chronic valvular disease, especially with evidence of cardiac failure. The dry diet treatment of cardiac disease with edema has long been recognized as an important one, the amount of fluid allowed being governed by the amount of urine passed. In chronic nephritis this rule cannot be applied as strictly. Forty to 50 ounces should be the maximum amount of fluid as drink allowed to patients. Occasionally, as Von Noorden has advised, the patient may take larger quantities of water, to cause a thorough flushing; but while taking this increased amount it should be noted whether it was rapidly passed by the kidneys or not, and, in patients with edema, if it has increased the edema. Whenever the latter occurs, the amount of water should be markedly restricted and free elimination by skin and bowels secured. When the amount of urine is above the normal, diuretics are not needed to increase the flow. The alkaline diuretics have very little, if any, power to increase the elimination of urea or other nitrogenous constituents of the urine, and the good effects that have been noted after their use are due to their action on the skin and bowels.

The use of diuretin, agurin, and theocin (see "Chronic Parenchymatous Nephritis") is indicated when diminution in the amount of urine and the appearance of edema are due to failure of cardiovascular compensation.

In the terminal stages of chronic nephritis, when the urine is diminished and edema is present, in addition to digitalis, strophanthus, and alcohol, either alone or combined with theobromin preparations, the more irritating types of diuretics may be used, as infusion of juniper, scoparius, triticum repens, etc. While these preparations are irritating to the kidney, and in acutely inflamed conditions harmful, in the chronic forms of nephritis some stimulation beyond the normal is necessary to cause the kidneys to perform their functions. Unfortunately, patients too frequently seek this diuretic relief by the use of some patent medicine advertised for the cure of kidney disease.

Cardiac hypertrophy and high arterial tension are to be considered part of the pathology and symptomatology of chronic interstitial nephritis, rather than as a complication. Upon the condition of the heart and the blood-vessels depend to a large degree the duration of the disease and its mode of termination. A large majority of patients with chronic interstitial nephritis die on account of gradual failure of the heart, rather than from loss of renal tissue. The treatment as regards the cardiovascular system is the guarding against failure of the heart, on the one hand, and excessive high arterial tension and danger of rupture of the blood-vessels, on the other. Cardiac failure in chronic nephritis is rarely sudden; generally it comes on insidiously, associated with anemia and failure of the general health. Usually the first symptom of cardiac insufficiency to attract the attention of the patient or physician is edema or one of the various forms of dyspnea. When these symptoms of commencing cardiac failure appear, it is necessary to readjust the daily life of the patient. Those who continue their business should understand that they must adapt themselves to their cardiac power; that exacting and annoying details of business should be avoided or delegated to others; that excitement and loss of temper are absolutely injurious; that their mode of life should be routine, and as uniform as possible; and that under no circumstances should any stress be thrown upon the cardiovascular system by either physical or mental effort.

As long as cardiac power compensates for obstruction in the circulation, no special treatment is needed. When the patient begins to suffer from loss of weight and strength, however, then the question of regulating the diet, the giving of tonics, as iron, arsenic, etc., must be considered. If the patient notices that his usual exercises begin to induce slight shortness of breath, or he is suffering at night from dyspnea, it may be necessary to add to the diet some alcoholic stimulant, not only for its effect upon the heart, but especially for its influence upon the general nutrition. In cases where there is danger of the patient abusing alcohol, or when for some other reason it cannot be given, then the use of cardiac stimulants is indicated. Digitalis or strophanthus, given in small doses at bedtime (tincture of digitalis, ♏iij to v; tincture of strophanthus, ♏v to vij), and the patient instructed not to get out of bed during the night for any cause, especially to urinate, relieves the dyspnea, increases the cardiac power, and appears to have some influence over cardiac nutrition. There is less danger when these drugs are given in this manner than continuing their use during the day, when the patient is up and about. They can be continued for a long time without producing any cumulative effect.

Since the introduction of instruments for accurately measuring blood-pressure, attention has been called to the changes in blood-pressure in different diseases, and there is danger of undue importance being given to high blood-tension as such. The blood-pressure should be considered in relation to the condition associated with it, and not as an isolated symptom. Increase of vascular tension is necessary in interstitial nephritis, and only when it becomes excessive does it demand treatment.

"A persistent high-tension pulse, to whatever cause it may be due, is injurious, but not with granular kidney, paradoxic as it may seem. The patient would be best without granular kidney, but, having a granular kidney, it is better with a high-tension pulse than with a low; in other words, the patient is worse when the tension is low" (West).

One of the difficult points to determine is when the tension has exceeded that necessary to carry on kidney secretion. If it exceeds this point, it is causing needless work for the heart, and there is liability of rupture of the blood-vessels. Isolated observation of the blood-tension in renal as in other diseases is an untrustworthy guide for treatment, as the tension varies markedly at different periods of the day and under different circumstances. When found persistently high, especially when it is associated with the passage of large quantities of urine, it is best treated by reducing the diet, as far as both solids and liquids are concerned, and increasing the action of the skin and bowels. A course of Turkish baths, or hot-air baths given at home, and free evacuation of the bowels daily, by saline cathartics, often reduces the tension. At no time should the reduction of the tension affect the general health or cause other symptoms. The iodids have been advocated for this purpose, as well as for the supposed action on the kidney lesion, as has already been mentioned. If continued for a long time, iodism should be guarded against. When there is marked fluctuation in the tension, associated with attacks of dyspnea and slight anginal pain, chloral may be used; but it must be administered with caution. While perfectly safe where the cardiac muscle is in a fair state of nutrition, and a high arterial tension is the only complicating condition, it should not be used when there is degeneration of the cardiac muscle, and the arterial tension, while not very high, is relatively too high for the cardiac power.

Preparations of the nitrites, as nitroglycerin, amyl nitrite, and sodium nitrite, either alone or in combination, have been chiefly used for the reduction of tension, and since the attention has been directed to high arterial tension as a symptom in disease, their use has become a routine practice in the treatment of nephritis.

In the treatment of cardiac and renal diseases the greatest danger, next to the abuse of digitalis, is the unjustifiable administration of the nitrites. High arterial tension is relatively a compensating condition in interstitial nephritis, and it is to be treated only when it becomes excessive. The action of the nitrites is transient, and the use of large doses at frequent intervals is apt to produce increasing irritability of the cardiovascular system, and the patient is more liable to suffer from dyspneic attacks. There is also danger of the nitrites reducing the tension temporarily below the point at which kidney secretion can be carried on.

One of the important things to be accomplished in the treatment of high arterial tension in nephritis is not to produce sudden variations, but to maintain the tension at a point that is just sufficient to meet the demands of the kidney. This cannot be accomplished by the use of the nitrites; they should be reserved for the relief of symptoms that are dependent upon a sudden and excessive elevation of the tension, as shown by attacks of dyspnea or anginal pain. When the cardiac power has become insufficient to maintain a uniform arterial tension, it has been the practice to administer the nitrites so as to relieve the work of the heart and increase diuresis, losing sight of the relation that arterial tension bears to kidney function, on the one hand, and to cardiac power, on the other. The giving of the nitrites may relieve the work of the heart temporarily, but when the tension has been lowered below a certain point, the kidney function is diminished, with danger of uremia and edema. No benefit is derived from still further lowering of the tension by the nitrites, and it is necessary to meet the condition by increasing cardiac power, or relieving the work of the heart by reducing the blood-mass through free diaphoresis and purgation.

On account of the decreased eliminative power of the kidney and the accumulation in the blood of substances that are ordinarily thrown off by the kidneys, it is necessary to induce elimination by the skin and bowels. During the early stages, when the patient is in fair health, the skin must be kept in good condition by bathing. A hot tub-bath or vapor bath may be taken two or three times a week before going to bed, or Turkish baths if they do not distress the patient. The morning tub-bath need not be discontinued if the patient reacts well. The water should not be too cold, and after the bath a good reaction should be induced by brisk friction. When there is evidence of cardiac failure, the Turkish baths should be used with great caution. Bathing in the open air and sea-baths are absolutely prohibited. The action of the skin should be promoted by muscular exercise, which must stop short of fatigue, and should not induce excessive perspiration. The use of drugs to cause increase of elimination by diaphoresis is not needed, except when there are symptoms of uremia. Exercise in the open air, besides stimulating the functional activity of the skin, induces elimination by the lung.

Sir John W. Moore has emphasized the importance of the elimination by the lungs in chronic nephritis, and shows that anemia can be prevented or combated and the power of the heart maintained by regular exercise. He believes that the open-air way of treating nephritis is as important as in the management of pulmonary tuberculosis. For this reason living in a climate suitable for free outdoor exercise is advantageous; but if the patient cannot go to such a climate, he should be warmly clothed and encouraged to take the necessary exercise.

Elimination by the Bowels.—The bowels should move at least once a day, and the movement should be rather free and watery. Widal has shown that when the bowels are free, the amount of salt contained in the feces is considerable, and when there is a tendency to retention of salt in the tissues and edema, an appreciable amount can be removed in this manner. Occasionally a dose of magnesium sulphate or effervescent salines or one of the aperient mineral waters should be given.

Broadbent has called attention to the good effect of the mild mercurial aperients in chronic nephritis. Mercury reduces the high tension, and its effects are greater than can be explained by the amount of purgation. He considers that the eliminative effects of mercury are not merely due to the catharsis, but may act on the impurities in the blood. It may be given in the form of 5 grains of blue mass, 3 to 5 grains of calomel, with double the quantity of bicarbonate of soda, or mercury with chalk, 3 grains at bedtime, followed in the morning by a saline. This may be given weekly or less often, as necessary. While the saline cathartics are extremely useful, care must be taken that they are not given to such a degree as to cause anemia.

Treatment of Nervous Symptoms.—The headaches and sleeplessness often demand treatment. At first they should be controlled by changing the mode of life, restricting the diet, and stimulation of the emunctories. This often is sufficient for the purpose if the symptoms are due to toxemia. When they are not controlled by this means, it will be necessary to administer drugs. Opium and its alkaloids are contraindicated in this stage. The bromids, especially the bromid of strontium, or the chloral preparations, as chloral hydrate (7½ to 10 grains), veronal (5 to 10 grains), trional (10 grains), or paraldehyd, may be used. When the attacks occur only at night, or the patient is awakened during the night with a headache, alternating with asthmatic attacks, cardiac stimulants may be needed, the guarded use of alcohol, or the nightly dose of digitalis. Hemiplegia and convulsions may be present without the ordinary symptoms of uremia. In many cases it is impossible to determine at first whether the hemiplegia is due to the rupture of a blood-vessel or is a symptom of uremic poisoning. Uremic hemiplegia is transient, lasting but a few hours or days, when the patient makes a perfect recovery. Repeated attacks of these symptoms are liable to occur, usually associated with sudden increase in pulse-tension.

In uremic hemiplegia the excessive blood-tension should be reduced as quickly as possible by repeated doses of nitroglycerin, $\frac{1}{100}$ to $\frac{1}{50}$ grain every half-hour to fifteen minutes. When convulsions accompany it, the use of chloral hydrate (10 to 15 grains by rectum) is efficacious. The bowels should be freely relieved by rectal irrigations of hot saline. With high blood-tension the fluid should be allowed to pass rather freely, as absorption is not desired. After the urgent symptoms are controlled, the treatment is that advocated for uremia.

On the theory that the kidney has an internal secretion the use of kidney extract has been advocated. This may be given in the form of tabloids of kidney extract, or it may be prepared from the fresh kidney in the following manner: Procure one or two absolutely fresh beef kidneys, chop fine, and thoroughly wash in cold water so as to remove any urine contained in the tubules. Then thoroughly pound (triturate) in a mortar with 20 ounces of normal saline solution. The mixture is allowed to stand for four hours, and the clear liquid decanted. This amount is taken during the day in three or four doses, either alone or combined with bouillon. It has been advised that the treatment be continued for ten days and then stopped for a week. It has been claimed that this treatment acts as a powerful diuretic, checks albuminuria, and causes the nephritic symptoms to disappear for a variable time; also that under its use perspiration is more freely induced by baths, and especially by drugs, such as pilocarpin.

While some have noted the good effects of the kidney extract or of the macerated kidney, others have failed to note any improvement. But, on the other hand, they claim that the patient's digestion is disturbed by it. Whether or not a more beneficial effect could be obtained from the kidneys of animals that are living on a mixed diet (proteids and vegetables) is a question.

AMYLOID DISEASE OF THE KIDNEY

Lardaceous degeneration of the kidney is a secondary disease, being most commonly due either to prolonged suppuration or to syphilis. The amyloid change is rarely limited to the kidney, but involves other organs, especially the spleen and liver. The course of the disease is modified by the degree with which the other organs are affected. In well-marked cases the kidney condition is rarely amyloid alone, but there are generally parenchymatous or cirrhotic changes in varying degree. When the amyloid condition is recent, with the removal of the cause, there is marked tendency to recovery. When the condition has lasted for a long time, secondary changes tend to make the renal condition permanent; and although the amyloid condition may be relieved, the patient suffers from evidence of renal disease.

As the degeneration is usually secondary to either suppuration or syphilis, the treatment of these conditions is most important. Amyloid degeneration does not occur in all cases of prolonged suppuration; and just what the factors of the suppurative process are that induce amyloid changes is unknown. Whenever suppuration is present, every means possible should be taken to arrest it, and if it cannot be absolutely cured, to compensate for the effects of the purulent discharge. All secondary infection should be avoided by the use of appropriate antiseptics. The patient should be fully nourished. Diet should be liberal, beyond that which is usual in most cases of kidney disease. In fact, the ordinary restrictions of diet are indicated only when the parenchymatous or fibrotic change predominates. In addition to the food, the patient should be given cod-liver oil, iron, and quinin.

Although but little is known of the chemistry of amyloid change, the fact that there is a large loss of potash in the suppurative process has led to the use of potash preparations in its treatment. Dickinson recommends the use of liquor potassi, ♏v to x, three times a day; it is to be given on an empty stomach.

When amyloid degeneration is secondary to syphilis, the treatment of this disease by means of iodid of potash should be energetic. The iodid of potash is preferable to other salts of iodid on account of the potash it contains. It is claimed that these cases bear mercury badly, so that it should not be used in the treatment of syphilis complicated by lardaceous disease unless the iodids fail to control it. After the syphilis has been controlled by the iodids, the use of the syrup of iodid of iron should be substituted, with frequent return to the iodid of potash to insure permanent results.

The complications that occur in amyloid kidney are chiefly diarrhea, uremia, secondary inflammatory conditions, especially pneumonia, pleurisy, pericarditis, and peritonitis. The diarrhea is profuse, painless, with absence of mucus, and is due to amyloid change occurring in the intestines. On account of the tendency to intestinal complications the treatment of the kidney condition by free purgation should be used with extreme caution. When diarrhea is present, it is controlled with great difficulty. The astringent vegetable and iron preparations are chiefly indicated, in combination with opium. Opium can be used with greater freedom in lardaceous disease than in any other disease of the kidney.

With the occurrence of diarrhea the patient rapidly loses flesh and strength, and every effort should be made to increase gastric digestion; drugs that are given with a view to controlling diarrhea should not cause any disturbance of the stomach or interfere with its function. The combination of the mineral acids, especially dilute sulphuric acid, with pepsin increases the digestive power and often exerts a control over the diarrhea. Inflammations of the serous membranes and of the lungs, next to diarrhea, are most frequent causes of death. The treatment is that usually given for these conditions, except that it should not be too energetic, and all drugs that cause irritation of the kidney or induce marked depression should be avoided. Treatment of the other symptoms that occur are the same as outlined in "Acute and Chronic Forms of Nephritis."

PYELITIS

Inflammation of the pelvis of the kidney may occur as—(1) Catarrhal pyelitis; (2) suppurative pyelitis with distention of the pelvis or pyonephrosis; (3) pyelonephritis, in which there is extension of the suppurative process to the substance of the kidney; (4) or suppurative nephritis, or acute interstitial nephritis with suppuration.

Acute simple catarrhal pyelitis may be due to exposure to cold; to overexertion with subsequent chilling; to slight injuries over the kidney region; to irritation of the pelvis of the kidney due to abnormal conditions of the urine, as hyperacidity, polyuria, presence of crystals of oxalate of lime or small calculi; to irritating effect of drugs, as turpentine, cantharides, etc. It may occur also during the course of infectious diseases, due to the toxins or the effect of the specific micro-organisms. It is especially liable to occur in typhoid fever. It may be due to extension of irritation from the lower urinary tract. The symptoms vary according to the cause; when due to "taking cold" or exposure, there will be slight rise in temperature, aching of the body, especially marked over the lumbar region; urination will be frequent, with burning at the meatus; the urine will be high-colored, and on standing will show a certain amount of sediment which contains epithelial cells. When due to the irritating properties of the urine, the bladder and urethral irritation will be more marked. Patients will complain of pain in the "small of the back," and there is general malaise with disturbance of the digestion. When pyelitis occurs in the course of an infectious disease, the symptoms are generally masked by those of the primary disease. When secondary to chronic cystitis, the symptoms are not distinctive, and generally there is slight increase in the intensity of the bladder symptoms.

Indications for the treatment of pyelitis will vary according to its cause and its severity, and in each case the particular cause should be sought for, as the removal of the primary cause, as well as of contributing factors, is most essential in the treatment.

Simple catarrhal cystitis, when due to "taking cold" or following an attack of influenza, typhoid fever, or other infectious disease, often recovers spontaneously.

Indications for treatment of simple catarrhal cystitis are, in the first place, treatment of the cause. When due to taking cold, etc., the patient should be put to bed, the bowels should be freely moved, and hot applications or counterirritation applied over the kidney. The diet should be simple and nutritious, milk with lime-water being the best. Patients should drink plenty of pure soft water. There should be avoidance of all alcoholic stimulants. If the urine is hyperacid, it should be corrected by the use of alkalis before meals. Direct action upon the pelvis of the kidney may be obtained by giving those drugs which are eliminated in the urine. These should be slightly sedative and astringent, as the infusions of flaxseed and melon-seed teas; fluidextract of buchu, ½ to 1 dram three or four times a day; fluidextract of uva ursi, 1 to 2 drams; pareira brava, either as an infusion (1 ounce to the pint) or the fluidextract (1 to 2 drams); infusion of triticum repens (1 ounce to the pint); or fluidextract of saw palmetto, three or four times a day.

In mild cases this plan of treatment is sufficient. Patients make a rapid recovery, but must be guarded against relapse by the avoidance of chill and overexertion.

When the irritation of the pelvis is due to the irritating condition of the urine, as hyperacidity or the presence of uric-acid crystals, the urinary condition must be changed by the giving of alkalis and the correction of the diet.

When oxalate of lime crystals are abundant in the urine and the cause of irritation, there should be free action of the bowels by mercurials and salines, which should be followed after three or four days by dilute nitromuriatic acid (♏ x), combined with one of the vegetable bitters taken after meals. This clears the urine of the crystals. The use of the acid mixture must not be continued after the crystals have disappeared, or it may produce hyperacidity of the urine and irritation.

When the pyelitis is due to the effects of irritating drugs, as cantharides or turpentine, either alone or associated with lead, etc., after the withdrawal of the drug irritation rapidly subsides. The patients should be instructed to drink freely of water, and to remain quiet as long as there are any urinary symptoms or lumbar pain.

Pyelitis may depend upon gastro-intestinal disturbance, as constipation or one of the catarrhal conditions. Attacks due to intestinal causes are especially frequent in children. With the removal of the bowel condition and the use of urotropin or salol, the pyelitis rapidly disappears.

Spontaneous or rapid cure of pyelitis is dependent chiefly on the absence of obstruction to the flow of urine from the kidney to the bladder. When there is no obstruction, the natural process of irrigation removes the infecting organism.

As long as the pelvis of the kidney is not distended, the catarrhal or suppurative condition is amenable to medical treatment. In pyelonephrosis the distention of the pelvis causes disturbance of the renal function and favors the extension of the suppurative process to the kidney itself. As the distention of the pelvis is due to some obstruction to the flow of urine, it is essential that the obstruction be removed; or if this is not possible, that its effects be minimized. Renal, vesical, and urethral calculi should be removed by surgical means; strictures of the urethra should be stretched or cut; narrowing of the ureters, secondary to cystitis, should be dilated; prostatic obstruction should be removed by operation, or its effects prevented by early and regular catheterization. All sources of infection should be guarded against. Infection of the bladder during catheterization should be prevented by observing all antiseptic precautions, and the danger of reflex vasomotor disturbance from catheterization should be evaded by having the patient remain in a warm room or in bed for some time after catheterization.

Obstruction to the flow of urine from the kidney may be caused also by displaced kidney, adhesions, or pressure of pelvic tumors. These causes should be removed by appropriate surgical treatment. In acute pyelonephrosis patients should remain in bed; in subacute or chronic cases they should not be closely confined to bed. Over-exertion should be avoided. Patients should not remain on their feet for too long a time; standing quietly for long periods is especially bad. Several times during the day they should assume the recumbent posture. The diet should be that of chronic nephritis, and when there is much interference with the flow of urine, the quantity of the urine should not be greatly increased by taking large amounts of fluid either as food or drink. The indications for rendering the urine bland and unirritating should not lead to the danger of increasing its quantity so as to cause overdistention.

While hyperacidity of the urine should be controlled, alkalinity should be avoided on account of the danger of inducing ammoniacal decomposition; at the most, the urine should be rendered neutral.

The use of the stimulating and antiseptic diuretics is indicated in this condition: Infusion of juniper, ½ ounce macerated in a pint of hot water for an hour; the oil of juniper, 5 minims, oil of origanum, 5 minims, three or four times a day; oil of terebinthina, 10 minims in emulsion, each dose combined with 1 dram of glycerin and 1 minim of gaultheria; oil of sandalwood, 5 to 10 minims in emulsion or elastic capsules; oil of copaiba, 5 to 10 minims. These two last preparations are especially efficacious, as they are markedly antiseptic, but do not produce irritation.

When ammoniacal decomposition has occurred, the combination of the essential oils or balsams with benzoic acid corrects the alkalinity and acts as an antiseptic and stimulant.

In the hyperacid urine the combination of an alkali with copaiba or sandalwood oil is often efficacious. The mistura "Lafayette" is a good type:

℞. Olei copaibæ
Spiritus ætheris nitrosi
Spiritus lavandulæ compositi .... āā ℥ iv
Liquoris potassi.............................. ʒ j
Mucilaginis acaciæ...................... q. s. ad. ℥ iv
Sig.—Tablespoonful three or four times a day.

The use of the astringents, tannic and gallic acid (2 to 5 grains), alum, tannate of quinin (5 to 10 grains), acetate of lead, and perchlorid of iron, has been advocated, but they are of doubtful value.

As urinary disinfectants, urotropin and other compounds of formaldehyd have been introduced. These preparations are not irritating to the kidney; their action is very rapid, being detected in the urine in fifteen minutes and persisting after a single dose of 7½ grains for six to ten hours. In some cases they increase the urinary distress.

Local treatment of this disease is now possible by catheterization of the ureters, which allows thorough drainage of the distended pelvis, followed by irrigation with a mild antiseptic fluid and instillation of nitrate of silver or some of the soluble silver salts. If distention of the pelvis is very great, or if there is evidence of suppuration in the kidney, its drainage through the loins and permanent catheterization of the ureters or removal of the kidney may be necessary.

Pain is often very acute in pyelitis, especially where there is overdistention of the pelvis itself. It is best relieved by morphin hypodermatically, or by a combination of opium with belladonna or hyoscyamus as a suppository.

Patients suffering from even a mild type of pyelitis are in danger of acute suppression of the urine from exposure to cold, after surgical operations, and during the course of acute disease. Sooner or later in chronic pyelitis the patient's health suffers from sepsis. The symptoms of this condition may be the characteristic temperature, with rigors, sweats, rapid pulse, and emaciation, or the fever may be of the typhoid type. In many cases the patients suffer from gastro-intestinal disturbances, chiefly loss of appetite, foul breath, nausea and vomiting, and constipation alternating with diarrhea.

In every case of chronic pyelitis the patient's general nutrition should be sustained by a generous but not too stimulating diet. Plenty of fresh air should be sought out-of-doors, and riding may be indulged in, but without overfatigue.

When symptoms of sepsis are present and are not controlled by medicinal treatment, operative relief should not be delayed.

The medicinal treatment of pyelonephrosis secondary to pyelitis or cystitis is merely palliative, and should be continued only when the case cannot be relieved by surgical operation.

Acute suppurative nephritis, whether due to injury, to infected emboli, or occurring without recognizable cause, is rarely controlled by the treatment. At the onset the treatment is that suitable for a case of acute catarrhal pyelitis or acute congestion of the kidneys. As soon as the suppurative nature is determined, the affected kidney should be treated surgically.

NEPHROLITHIASIS

Renal calculi are due to the crystalloid substances, which are normally held in solution in the urine, being deposited and the crystals cemented together around some substance, as a collection of cells, mucus, blood-clots, etc., which serves as a nucleus.

Crystallization occurs—(1) On account of some abnormal factors in the urine, due to defective metabolism; (2) excess of the normal products; (3) diminution of the watery elements of the urine or substances that normally hold the crystalloid material in solution; or (4) changes in the urine that occur after secretion, as ammoniacal decomposition, etc.

For calculi to be formed, in addition to the decomposition of crystals some substance is necessary to bind them together; this substance is derived from the abnormal secretion of the lining membrane of the tubules, calyces, or pelvis of the kidney due to catarrhal or purulent inflammation. Every renal calculus consists of crystalloid and organic matter.

The most common form of renal calculi are: (1) Uric acid; (2) oxalate of lime, and (3) phosphatic. The rarer forms are the mixed forms, cystin, and urate of ammonia. Renal calculi occur with peculiar frequency in certain sections of the country. The tendency also appears to be hereditary, and is aggravated by sedentary life, by faulty diet, and possibly by salts of lime contained in food and drinking-water. In certain sections where calculous diseases were especially frequent the introduction of pure soft drinking-water has caused the disappearance of the condition.

The most important part of the treatment is prophylaxis, which should aim: (1) To prevent the precipitation of crystals from the urine; (2) when crystallization has occurred, to prevent the conglomeration by removing them as rapidly as possible from the kidney; and (3) to prevent the necessary binding substance being present.

Prophylactic treatment necessitates that the nature of the stone be known. The diagnosis of the character of the stone can generally be made from the urine. Uric-acid calculi occur in hyperacid urine containing a brick-dust deposit; calcium oxalate calculi, in urine showing an abundance of light, flocculent sediment, which under the microscope shows crystals of oxalate of lime. The phosphatic calculi occur in alkaline urine, the sediment of which is thick, white, and creamy, giving much the appearance of pus; on the addition of a few drops of acid the urine clears up. Under the microscope the sediment has a characteristic appearance. Frequently when there are symptoms of stone in the kidney, but the urine does not give the above appearance, the diagnosis rests on the microscopic findings of blood and casts, with primary crystals of uric acid, oxalate of lime, cystin, etc.

The knowledge of the character of the stone is necessary in order to prescribe the diet, as food leads to the formation of a particular kind of stone, and influences the solubility of the substances forming the stone. It is necessary for the diet to be a mixed one, for although, according to the character of the stone, certain articles of food should be restricted, an exclusive meat or vegetable diet should never be followed.

On account of its tendency to precipitation of uric acid in the urine its introducion as food shoultd be prevented. As uric acid is chiefly formed from the nucleoproteids, all meats should be forbidden which contain a large amount of cellular elements, as sweetbreads, liver, kidneys, flesh of young animals. Light bouillon and soups are not contraindicated. The proteid portion of the food should be meat, either light or dark, milk, and eggs. Patients should eat freely of farinaceous dishes and vegetables. In many cases the excess of uric acid in the urine is not derived from food, but from the patient's tissues. In other cases the process of metabolism is so faulty that even on a suitable diet excess of uric acid is produced. Uric acid appears in the urine in two forms, either as a soluble salt or as uric acid itself. Uric acid itself is very insoluble and is held in the urine in suspension. The acidity of the urine influences the precipitation of uric acid. On an excessive meat diet the urine becomes hyperacid, and uric acid as such constitutes 80 to 90 per cent. of that found in the urine, the soluble salt being correspondingly decreased. When the acidity of the urine is reduced by a vegetable diet, there is a greater proportion of the soluble form. On a proper mixed diet the two forms of uric acid elimination occur in about equal amounts, and the low acidity of the urine holds the uric acid in suspension. On a rather free meat diet the acidity of the urine can be controlled by the giving of alkalis. Sodium bicarbonate, 15 to 20 grains three to five times a day, is best, given one or two hours after meals. Potassium citrate, 30 grains every three or four hours, dissolved in a glass of water, may be given. Potassium acetate, sodium acetate, or lithium salts may be given in the same manner. The alkali can be administered in the form of natural or artificial mineral water.

The carbonic acid gas of aërated waters favors the solubility of the uric acid. The effect of the alkaline mineral waters on the urine is rapid but transient, and when they are given for the purpose of reducing the acidity, it is necessary to administer them frequently. Calcium carbonate has been advised in place of the other alkalis; it is given in 10- to 15-grain doses three times a day, although much larger doses have been given with good effect and without disturbing the digestion or rendering the urine so alkaline as to favor the formation of phosphatic calculi. In place of the calcium carbonate the Contrexeville, Wildungen, or Fachingen waters have been given.

Lysidin, piperazin, and similar compounds have been much vaunted as solvents of uric acid, but they are of very little actual value beyond the amount of water they cause the patient to drink. As precipitation of uric-acid crystals is favored by hyperacidity of the urine, the diurnal variation in the acidity of the urine should be considered in administering alkalis. During the day, especially after meals, the acidity of the urine falls. At night and in the early morning hours, or when the patient is fasting, the acidity rises. It is at this period that the patient is apt to complain of pain in the back and distress, referred to kidney and ureter, due to the sudden showers of uric-acid crystals.

To influence the urine during the periods of diurnal high acidity the alkali should be given at night, and at as late an hour as possible. The dose should be a large one, 60 grains of sodium bicarbonate or potassium citrate in half a pint of water; liquor potassii, 10 to 20 drops in milk. If the acidity of the urine is very high, frequent doses of the alkali may be necessary during the night.

Sir William Roberts advises the use of chlorid of sodium in conjunction with the alkalis; or that the alkali should be given in conjunction with the saline mineral waters. The alkali should not be used to such an extent as to render the urine alkaline, except for a very short time. Where it is necessary to continue the use of the alkalis for a longer period, they should be given in quantities sufficient to reduce the acidity within the range of normal, or at most to render it neutral.

Hyperacidity of the stomach favors the production of calculi; it allows the salts of the food to pass into the urine more readily and to increase its specific gravity. All articles of food which favor hyperacidity should be avoided.

When precipitation has occurred in the kidney, it is necessary to remove the crystals as quickly as possible, before they can be united to form a stone. Calculi rarely form when there is a free flow of diluted urine.

The patient should be directed to drink fluid freely; pure soft water is the best, although many patients complain that the necessary amount of water disturbs their digestion, but are able to take sufficient quantities in the aërated mineral waters. The patient should pass at least about 60 ounces of bright, limpid urine during the twenty-four hours. After the uric-acid crystals have been deposited and conglomerated into a calculus they cannot be dissolved, and the use of the so-called lithotriptics for this purpose is useless. Disintegration of the calculus does at times occur, but it is due to the removal of the binding substance derived from the abnormal lining of the urinary tract, and the prevention and cure of catarrhal or purulent processes in the kidney is a most important part of the treatment. (See Pyelitis.)

Oxalate of Lime Calculi.—The oxalate of lime found in the urine is chiefly derived from food; the major part comes from spinach, rhubarb, sorrel, tomatoes, onions, turnips, tea and cocoa, and the gristle of meat. The lean part of meat, vegetables, except those mentioned above, and farinaceous foods contain it in small quantities only. The salts of oxalic acid contained in the food are in an insoluble form, but are set free by the hydrochloric acid of the gastric juice. The amount of oxalic acid in the urine is markedly influenced by the acidity of the gastric juice, and can to a certain extent be controlled by the use of alkalis and anti-acids with meals. Calcium oxalate is held in solution in the urine by salts of magnesium derived from meat, legumes, potatoes, apples, and farinaceous foods, and the calcium salts found in milk, eggs, and green vegetables.

On account of a tendency to the formation of oxalate of lime crystals in the urine, and with the object of withdrawing those articles which contain oxalic acid salts, the treatment of gastric hyperacidity is most important. Sodium phosphate has a tendency to hold calcium in solution in the urine. It is best given as a laxative in the morning, one teaspoonful in a half-pint of hot water, or the effervescing salts in cold water. During the day 20 to 30 grains can be given after meals. The sulphate of magnesia in 30-grain doses, three times a day, has been advocated for the same purpose. When oxaluria is present, it is best controlled by the use of a calomel and saline purge or a laxative mineral water, followed by 10 minims of nitromuriatic acid and a vegetable bitter, as 1 dram of tincture of cinchona, for a few days. The acid should not be continued too long.

Phosphatic Calculi.—Calcium phosphate is precipitated from alkaline urine. The urine may be alkaline on account of ammoniacal decomposition caused by the bacteria, or on account of increase of fixed alkalis due to the gastric condition or the diet.

The alkalinity of the urine should be corrected by the treatment of the cause; the digestive disturbances should be corrected; the diet should be a mixed one, but vegetables and fruit should be taken only in quantities sufficient for good nutrition. Alkalis and alkaline waters should be prohibited. Plain soft water or aërated water may be given. The urine may be rendered acid by the use of the mineral acids, as nitric, hydrochloric, or sulphuric acid. The latter is best, given in the form of sulphuric acid lemonade, 10 to 15 drops of the dilute or aromatic sulphuric acid in a goblet of sweetened water. It has been claimed that saccharin has an antiseptic action and should be used in place of sugar. Hutchinson advises the use of acid phosphate of sodium, 30 to 80 grains every three hours, or 2 drams dissolved in a pint of water, and a small quantity drunk frequently during the day. Benzoic acid and sodium benzoate, 10 to 15 grains, boric acid, 5 to 10 grains, are used to correct the ammoniacal decomposition.

The condition of the lining membrane of the tubules, calyces, and pelvis of the kidney has a very important influence, not only on the precipitation of the crystals, but it furnishes the nucleus around which the crystals are deposited, and also the substance which cements the crystals together.

Whenever pyelitis is present, the reaction of the urine and all those factors which predispose to precipitation should be avoided. After the stone has been formed the resulting irritation of the inflammation should be treated as outlined under "Pyelitis."

Retention of urine in the pelvis of the kidney favors rapid increase in the size of the stone or the formation of other stones. Ammoniacal decomposition may cause a deposit of phosphatic crystals upon a primary uric acid or oxalate of lime calculus. When the secondary pyelitis cannot be controlled by the treatment, the stone should be removed by nephrotomy before pyelonephritis occurs and the health is undermined by sepsis.

Calculi may remain in the kidney for a long time without producing any very definite symptoms, although the patient may complain of vague lumbar discomfort, pain in the thighs, cramps in the calves of the legs or toes, or gastric disturbance.

Renal colic calls for active palliative treatment. The pain may demand the use of opium or one of its alkaloids. If pain is not severe, these may be given by the mouth; but if repeated doses are necessary, this method of administration is dangerous, as during attacks of pain nausea and vomiting may prevent its retention, or if retained in the stomach absorption is delayed or prevented, and with the cessation of the attack the whole amount rapidly passes into the circulation and poisoning occurs. Especially dangerous is the habit of leaving with the patient a quantity of opium or morphin to be taken at short intervals until the pain is relieved. Overdosage is almost sure to occur in any severe or prolonged attack. In severe cases morphin should be given hypodermatically, combined with atropin, which not only antagonizes the narcotic tendency of morphin, but also acts on the nerve-endings in the genito-urinary tract. When the morphin is not given hypodermatically, it may be used in suppositories combined with belladonna or hyoscyamus.

Spasm of the ureters frequently cannot be controlled by morphin without producing dangerous narcosis. The use of spiritus ætheris compositus, 2 to 4 drams, diluted with 2 to 4 ounces of saline solution and injected into the rectum, acts as an antispasmodic. Extreme paroxysms of pain can also be modified by allowing the patient to inhale a few whiffs of chloroform. Hot applications over the lumbar region and abdomen and hot baths aid in relieving the spasm.

Attacks of renal colic may last for days with slight intermissions; or for weeks the patient may have short attacks of pain, and with each attack is conscious that the stone has passed further down the ureter.

In slow passage of the stone down the ureter or its impaction the patient should drink freely of any fluid that he can be induced to swallow—water, tea, cocoa, lemonade, mineral waters, wine, or beer. Four to six ounces of fluid should be taken every hour to produce a free flow of urine and force the stone through the ureter. This treatment is not to be used when the patient already suffers from hydronephrosis.

Klemperer claims that glycerin, 2 to 4 ounces a day by mouth, favors the passage of the stone, although no reason is known why it should.

Massage around the course of the ureter, pressure, and mechanical vibration have all been advised as means of aiding the passage of the calculus. Patients usually object to these procedures, as it increases their pain, and the results do not warrant the added distress.

Hematuria may be very severe, and may occur with colic or without it. It cannot be controlled by giving the vegetable or mineral astringents or other hemostatics. When relief from pain is not obtained in a reasonable time, and excessive hematuria or other complications are present, operation should not be delayed.

After an attack of renal colic the voiding of the calculus per urethram should be watched for; the patient should be instructed to pass the urine in a vessel, or, if this is not possible, to carry a piece of cheese-cloth of suitable size and strain the urine through at least two thicknesses of it. All small particles caught in the vessel or on the cheese-cloth should be saved. If the nature of the stone has not been determined before the attack of renal colic, a chemical examination of the particles is necessary for prophylactic treatment against other attacks.

The traumatism produced by the passage of the stone causes more or less pain to be felt in the genito-urinary tract. The urine should be rendered as free and mild as possible; its reaction should be nearly neutral. Infusion of buchu, uva ursi, or small doses of oil of copaiba and sandalwood act as astringents and control the catarrhal inflammation.

HYDRONEPHROSIS

Dilatation or overdistention of the kidney with urine may be either congenital or acquired. The congenital cases are occlusion of the ureter by membranous bands or other anomalous twisting. Crystals of uric acid, so common in the fetus or newly born, may obstruct a ureter which is congenitally narrowed.

The acquired causes of hydronephrosis are obstruction of the ureter by calculi; pyelitis with secondary contractions involving the ureter; occlusion of the ureter by malignant growth and other tumors involving the pelvic organs; pelvic inflammation with subsequent contraction of tissue surrounding the ureter; cystitis causing narrowing of the opening of the ureter into the bladder; overdistention of the bladder from obstruction to the flow of urine through the urethra.

Hydronephrosis generally affects both kidneys when the cause is situated in the bladder or lower genito-urinary tract. In congenital conditions one or both kidneys may be involved. When the cause is in the ureter only, it is generally unilateral.

Treatment of hydronephrosis is almost entirely surgical. Organic causes cannot be removed by drugs. When the obstruction is due to calculi or depends upon the recurring inflammatory conditions, medicinal treatment directed to the primary cause may be of some avail.

When the case is seen early and the cause cannot be removed by treatment, operation should not be delayed, although the hydronephrosis may be small and painless. The tendency is for the distention to become greater, and with absorption of kidney substance, early operation should be performed in order to preserve the function of the kidney, if possible.

Paracentesis should be performed only for temporary relief.

CYSTS OF THE KIDNEY

Cysts of the kidney either may be congenital or may be formed after birth. Congenital cysts may involve one or both kidneys. The kidneys may contain one or more cysts of varying size, which do not appear to disturb the function of the kidney. They are generally developed at the surface of the organ; when they are large, they may produce some pressure, with atrophy of the surrounding kidney tissue. In chronic interstitial nephritis small visible or microscopic cysts, due to dilatation of the tubes, may be present. These cannot be diagnosed during life, and are part and parcel of the pathologic changes in interstitial nephritis. One or both kidneys may undergo general cystic degeneration. The kidneys may contain a large number of cysts of varying size, which may rupture into one another, giving cysts of larger size. Secondary change may occur in these cysts, and the contents may become purulent, hemorrhagic, or with the absorption of the liquid portion they may contain solid material, pus, fat, epithelium, and crystals. The kidney may be involved by cysts starting in perinephritic tissue; as these cysts enlarge they press upon the kidney and cause absorption.

Medicinal treatment has no control over degeneration, nor can it cause the absorption of fluid within the cysts. Surgical treatment is demanded when the cysts by their size exert pressure upon the kidney or surrounding organs, or when suppuration and abscess occur in the cyst and cause systemic poisoning.

HYDATIDS OF THE KIDNEY

Next to the liver and lungs the kidney is liable to be involved by hydatids. The hydatid cysts may be situated immediately beneath the capsule or be in the kidney substance. With increase in the size of the cysts the whole kidney may be destroyed, or the cysts may rupture, and their contents be voided through the ureters. Not so common is rupture of the cysts into the abdominal or thoracic cavities.

Sir William Roberts says that hydatids of the kidney have a natural tendency to discharge through the ureters; fifty-three out of sixty-three cases collected by him discharged in this manner. Of these sixty-three cases, twenty recovered, nineteen were fatal, and the result of the other twenty-four was not known.

The treatment of hydatid cyst depends upon its course and the rapidity of its development; when small and stationary, no treatment may be needed. In rapidly developing tumors surgical operation only is justifiable. When the cysts discharge through the ureter, spontaneous cure may occur; when the daughter-cysts occlude the ureter and attacks of renal colic are frequent and severe, surgical relief is necessary.

On account of the tendency of the contents of the cysts to produce secondary irritation of bladder and ureter, the urine should be rendered as mild and antiseptic as possible. It is especially important that the bladder be able to empty itself thoroughly of the contents of the cysts.

TUMORS OF THE KIDNEY

The medical treatment of tumors of the kidney is limited to palliative treatment. The non-malignant forms are generally small and do not produce any well-marked symptoms that demand treatment. Adenomata are small, generally the size of a hazelnut, and rarely reach the size of an orange, and except when large, do not give rise to any symptoms. Lipomata are so rare that their occurrence has been doubted.

Angiomata cavernosa are usually small, and, unless situated in the pelvis of the kidney, give rise to no symptoms. Pelvic angiomata may give rise to persistent exhausting hemorrhage which cannot be controlled by medicinal treatment.

Papillomata are rarely large enough to give rise to physical signs, but may cause hematuria.

Fibromata are usually small and produce no symptoms, although they may attain a size sufficient to demand surgical interference on account of the pressure.

The malignant tumors of the kidney are sarcoma and carcinoma. Sarcoma may be congenital or occur primarily later in life. Congenital sarcoma is generally fatal within the first few months after birth, especially if of the round-cell or of the mixed variety. Rarely does the child live beyond two or three years. The tumor may be unilateral or bilateral. When unilateral, the removal of the tumor is rarely survived, as young children do not bear operation well. When they have recovered from the operation, they generally die from recurrence of carcinoma in the other kidney. In the adult primary carcinoma of the kidney is rare; one kidney alone is generally involved; the tumor grows rapidly and pain and hematuria are generally present. The pain can be relieved only by full doses of opium or its alkaloids. These drugs should be given only when pain is present. The hematuria may be very profuse and it is not controlled by medical treatment. In addition to the ordinary vegetable and mineral astringents fluidextract of eucalyptus, 15 minims, or tincture of thuja, 15 to 30 minims, has been recommended.

The bowels should receive careful attention, as the passage of hardened feces or the pressure of a distended colon increases the pain and may be the exciting cause of hemorrhage. The diet should be as nutritious as possible. When the growth, either on account of the size, pain, or hematuria is endangering life, removal of the kidney may be necessary. If the patient survives the operation, there is usually in a few months recurrence in other portions of the body.

Carcinoma of the kidney occurs chiefly as encephaloid or scirrhus. The colloid form and epithelioma are extremely rare. Carcinoma of the kidney is rarely primary, and when it does occur, is non-malignant. Secondary carcinoma is usually bilateral. The treatment of carcinoma differs in no respect from that of sarcoma.

HYPERNEPHROMA

Hypernephroma may be regarded as a special form of malignant tumor affecting the kidney. The prevalent view is that hypernephroma arises from latent embryonal inclusion in the kidney of adrenal tissue which may begin to proliferate at almost any period of life, but chiefly in the cancer age, but may do so also in youth and even in infancy. Its tissues present peculiarities of all the simple forms of malignancy.

Hypernephroma grows more slowly than the simple malignant forms, and does not seem to penetrate the renal capsule; the tumor corresponds in general to the form of the kidney. Compensatory hypertrophy of the opposite kidney is often present. In many cases the tumor is only potentially malignant. Much depends on the natural vigor of the patient. If he is in bad health, the growth is much more rapid, but the growth may reduce the normal vigor before there are any local symptoms.

The most frequent symptoms are spontaneous or induced pain in the region of the affected kidney, a tumor in the kidney region, and hematuria which varies greatly with the case. Recurrent hemorrhage is very common. In many instances no bleeding occurs. Diagnosis is extremely difficult, especially if hematuria is absent.

On account of slow course of the growth and the absence of local destruction of tissue hypernephroma holds out considerable hope of cure by early operative intervention.

PERINEPHRITIC ABSCESS

Suppuration of the connective and adipose tissue about the kidney may occur: (1) As a primary condition without any determinable cause. (2) Secondary to diseased conditions of the kidney itself, or to infiltration of urine or pus from the genito-urinary tract. (3) Due to extension of inflammation from the adjacent organs other than the kidney.

Treatment.—In primary inflammation of the perinephritic tissue before suppuration occurs the process may be checked by local treatment, as dry cupping, hot or cold applications, turpentine stupes, wet cupping or leeches over the kidneys, and the internal administration of full doses of quinin, either alone or combined with the tincture of aconite, 5 drops, repeated every two hours until the pulse is affected.

The bowels should be freely opened by salines, either alone or in combination with a mercurial. Still further determination of blood from the tissues may be favored by the use of a hot rectal enema. The pain is relieved by the use of opium or its alkaloids, hypodermatically, by mouth, or in the form of a suppository. The diet should be fluid and non-stimulating—milk and light broths chiefly. Patients should be placed in bed at once and absolute rest insured.

The relation of the perinephritic tissue to the psoas muscle causes the pain to be referred chiefly to the hip and thigh, so that the diagnosis of lumbago or sciatica is liable to be made. The urine may not show any albumin or pus. With the subsidence of acute inflammation, the further resolution may be favored by the use of iodid of potash internally, and the application over the kidneys of iodid or mercurial ointment. As soon as pus is suspected, or if the acute symptoms are not controlled by the treatment, an exploratory incision should be made.

ACUTE CYSTITIS

Acute inflammation of the bladder, or cystitis, may be—(1) simple or aseptic or (2) septic.

Simple cystitis may be due to: (*a*) Traumatism, as from the introduction of sterile instruments into the bladder, injury to the perineum or hypogastric region, pressure of pessaries, uterine displacements, fecal accumulations, or child's head at parturition. (*b*) Irritation of mucous membranes by injections, or by the presence in the urine of cantharides, turpentine, balsams, and volatile oils. In some cases calomel and salicylic acid and its salts cause bladder irritation. (*c*) Irritation of the bladder may be caused by changes in the urine, as hyperacid or alkaline urine; a specific gravity that is too high or too low; crystals in the urine, as uric acid and oxalate of lime and phosphates. (*d*) Overdistention of the bladder in diabetes insipidus, polyuria, or prolonged retention of the urine. (*e*) Too frequent or intense muscular contraction of the bladder, due to hypersensitiveness, or reflex irritation from the rectum, sexual organs, or other portions of the genito-urinary tract; or from obstruction to the flow of urine from the bladder, due to stricture, calculus, etc.

Simple cystitis may occur from severe chilling, especially if the feet become wet and cold, or if the circulation of the bladder has been disturbed from any of the foregoing causes or from chronic congestion.

Septic cystitis is due to presence in the bladder of micro-organisms, especially streptococcus and staphylococcus, gonococcus, and bacillus coli communis. In the normal bladder these germs have very little tendency to excite acute inflammation, but when the mucous membrane of the bladder is inflamed or irritated from any of the causes mentioned in considering simple cystitis, or the circulation of the bladder has been disturbed on account of congestion or previous disease of the bladder, the micro-organisms readily induce a septic process.

The infection of the bladder may be caused by the introduction of dirty instruments or contaminated injections; by extension of infection from the kidney or ureter, either by the urine or through the lymph-channels; by extension upward through the urethra; or by the passage of micro-organisms from the inflamed areas in the neighborhood of the bladder.

In acute infectious diseases the specific micro-organisms of the primary disease may cause a cystitis. This occurs most frequently in typhoid fever, scarlet fever, diphtheria, and smallpox. The acute cystitis that occurs in other infectious diseases is generally due to changes in the reaction, specific gravity, or composition of the urine, rather than to the microbic cause of infectious disease.

In the treatment of acute cystitis the discovery of the causes, both predisposing and exciting, and their removal, if possible, are most important. The fact that acute inflammation of the bladder can be non-septic and due to causes that produce acute hyperemia of the bladder should always be kept in mind, as the attempt to control the supposed septic infection in the bladder by cleansing and antiseptic injections often increases the inflammation and prolongs the attack.

Non-septic cystitis runs a short course; when it is prolonged, it is due either to too energetic treatment or to the occurrence of secondary septic infection. In the acute stage of cystitis washing of the bladder is never indicated when the urine is bland and the bladder thoroughly empties itself at each urination. Should there be retention and decomposition of urine which cannot be controlled by other means, then washing out of the bladder should be employed, even if the inflammation is very acute. The irrigation should not cause irritation or increase the inflammation. Mild solutions should be used, as—normal saline; boric acid, 1 : 100; creolin, 1 : 1000 to 1 : 500; permanganate of potash, 1 : 15,000 to 1 : 10,000.

Care should be taken not to overdistend the bladder or to force into it septic micro-organisms from the urethra. A blunt nozzle shaped like a flattened cone should be used; this is introduced into the meatus. The vessel holding the solution should be raised not more than 6 to 8 feet above the level of the bladder. The solution is allowed to flow until the anterior urethra is fully distended; the stream is then stopped and the nozzle removed, and the fluid contained in the urethra is allowed to run off. It is necessary to repeat the urethral washing several times, so as fully to cleanse it, after which the nozzle is held firmly in the meatus and the urethra distended until the compressor urethræ muscles yield, and the solution passes into the bladder. In order to force the fluid from the urethra into the bladder, it may be necessary to raise the vessel holding the solution somewhat higher, but as soon as the fluid begins to pass into the bladder, the vessel should be lowered. Distention of the bladder should not be carried beyond the point when the patient feels that he must urinate. The desire to urinate may occur before the fluid is forced into the bladder, but it is due to the contraction of the urethral muscles. The desire to urinate that occurs after the fluid has entered the bladder should be taken as a guide to the amount of distention. If pain or tenesmus is so great as to prevent the patient from emptying the bladder, it may be necessary to introduce a soft catheter in order to empty the bladder. The catheter should be introduced very gently; if it cannot be passed into the bladder with slight pressure, it may be necessary to inject into the deep urethra a 4 per cent. solution of cocain. After the catheter has been introduced and the bladder emptied, if there is any decomposition of urine or evidence of septic infection, the bladder should be washed out while the catheter is *in situ*.

Patients with acute cystitis should be put to bed in a warm room. All chilling of the body should be avoided; as urination is very frequent, they should use a urinal, and not be obliged to get out of bed to relieve the bladder. As many people cannot empty the bladder, even when it is in a normal condition, when lying in bed, getting out of bed is sometimes necessary in order to prevent retention and overdistention. In such cases the room should be warmer than the ordinary sick-room.

The bowels should be thoroughly relieved, preferably by salines. All cathartics that cause irritation of the rectum or add irritating substances to the urine should be avoided. The movement of the bowels should be without griping.

The diet should be nutritious and easy of digestion—preferably a liquid diet. If the patient can digest milk, it is the most suitable food.

The urine should be rendered bland and non-irritating and slightly antiseptic. To dilute the urine, water should be drunk freely. Hot water, either pure or in the form of very weak tea or added to milk, is often better borne than cold or aërated water. The amount of fluid taken and its effects upon the urination should be watched in each individual case. The amount of urine should not be increased to such a degree as to cause too frequent micturition. It should be just sufficient to counteract the tendency to overconcentration, but not enough to increase the activity of the bladder.

Hyperacidity of the urine should be controlled by the administration of vegetable acids, as lemon-juice, etc. The alkalis may be given, especially carbonate of soda and potassium citrate. When the urine is only slightly overacid, milk diluted with equal parts of Vichy and other alkaline waters may be sufficient.

It is very important not to render the urine too alkaline in acute cystitis; at the most it should be only slightly alkaline. When there is tendency to retention of urine in the bladder and ammoniacal decomposition, it may be necessary to reduce the hyperacidity, but have urine still remain slightly acid. The urine should never be allowed to fluctuate widely in reaction. If the urine is too alkaline, either from digestive conditions or on account of ammoniacal decomposition, it should be rendered acid by the use of boric acid, benzoic acid, benzoate of soda, or camphoric acid.

To render the urine slightly antiseptic, salol, 5 grains, t. i. d.;

boric acid, 10 grains, t. i. d.; urotropin, 10 grains, t. i. d.; resorcinol, 5 grains, t. i. d.; or guaiacol, 5 to 10 grains, may be given. It has been claimed that urotropin is superior to all other preparations for rendering the urine antiseptic; that its action is very rapid, the drug being detected in the urine fifteen minutes after a single dose; that its influence persists for a longer time, and that it does not cause any bad effects, although in some cases it causes some irritation of the neck of the bladder. While urotropin has a very marked antiseptic action on acid urine, it is not as active in alkaline urine, and very frequently causes irritation of the bladder, with frequent micturition.

The balsams, oil of sandalwood, oil of copaiba, etc., have an antiseptic action, in addition to the specific action on the mucous membranes. The combination of oil of sandalwood or oil of copaiba with salol or benzoate of soda is especially efficacious, as was described under "Pyelitis."

To relieve the pain and tenesmus, opium or one of its alkaloids may be necessary. When the distress is extreme, it may be necessary to give it hypodermatically. When pain is not so severe, and especially when the tenesmus causes distress, suppositories containing extract of opium, gr. ½ to 1, extract of hyoscyamus, gr. ¼, or extract of belladonna, gr. ⅛, frequently give relief.

The frequency with which morphin and suppositories are given depends upon the individual case. They should be given until the pain and bladder irritation are controlled. In cystitis involving chiefly the prostatic urethra and the vesical trigonum the pain is frequently uncontrolled by opiates, and the patient is constantly attempting to urinate; in such cases it is frequently necessary to use instillations of a 4 per cent. solution of cocain (10 minims) or a 5 per cent. solution of nitrate of silver. In extreme cases continuous catheterization may be necessary. To relieve the congestion of the bladder, hot normal salines may be used; cold normal saline enemas have been advocated at the onset of acute non-septic cystitis. They can be used only during the onset of the disease, as later they increase the distress. Counterirritation may be made over the perineum and suprapubic region by the use of hot fomentations, turpentine stupes, or mustard plasters. Relief is often obtained by the use of the hot sitz-bath or hot tub-bath.

After the subsidence of the acute symptoms and during convalescence the patient should be carefully guarded against chilling, and against all circumstances that tend to cause a recurrence of the cystitis.

The diet should be a simple one, and all those articles that increase the irritating properties of the urine should be avoided. The reaction of the urine should be watched, and the patient should continue to drink water freely. All overexertion, especially from walking or standing, should be avoided. Whenever the patient notices that there is a tendency to increase in the frequency of urination, he should remain in a recumbent posture for a certain time each day.

The local treatment of the bladder will depend upon the condition of the urine; if there are fermentation and decomposition and much mucus, it should be thoroughly washed out with mild antiseptic solutions. As it is impossible to disinfect the bladder thoroughly, the stronger solutions should be avoided. If the irrigations produce irritation or increase frequency of urination, they should be stopped. Unless marked relief is obtained by the irrigations in a few days, they should be discontinued, as frequently they prolong the bladder irritation.

CHRONIC CYSTITIS

Chronic cystitis may follow an acute cystitis due to infection of the bladder, or may occur without a previous acute cystitis, being dependent upon retention of urine due to some obstruction of the flow, as urethral stricture, prostatic enlargement, tumors of the bladder, muscular weakness due to spinal injury or disease, constant irritation of the bladder due to the presence of calculi or vesical tuberculosis. The resistance of the bladder to septic infection is lowered by the passive congestion, whether due to interference with the general return circulation, or due to a local cause, dependent upon the pressure of uterine or other tumors.

The treatment of chronic cystitis is modified by the cause. All interference with the flow of urine should be corrected, if possible. All strictures should be dilated or cut. The effects of a prostatic enlargement should be minimized by thorough emptying of the bladder by catheterization, if the muscular power of the bladder is insufficient to do it. Patients should be warned to urinate at stated intervals and not to allow overdistention. The vesical calculus should be removed by operative means. Circulatory disturbance of the bladder should be combated, if possible, by improvement of the general health of the patient. Benefit is also obtained in passive congestion due to interference with the return circulation by having the patient rest in the recumbent position with the hips elevated. With the removal of predisposing causes the bladder rapidly regains its normal resistance, and septic inflammation has an inherent tendency to subside. The general health of the patient should be improved in every possible way. While chronic cystitis is not benefited by prolonged rest in bed, acute exacerbations occurring in the course of chronic cystitis should be treated by rest. In chronic cases the patient should be encouraged to take exercise, but should avoid becoming overtired.

The diet should be simple and nutritious. The bowels should be thoroughly regulated so as to prevent absorption from the intestines, and the large intestine should not become overloaded or distended. Patients should drink freely of water. If there is a tendency for the urine to become alkaline, the alkaline waters should be avoided. In interference with the flow of urine and retention the patient should not take so much fluid as to overtax the bladder and lead to distention.

When sleep is disturbed at night on account of frequent urination, the patient should not take much fluid late in the afternoon and evening. In the morning hours there should be a freer use of water. In cases of anemia tonics should be given, especially the mild forms of iron. Constipation should be overcome by combining with the iron a mild laxative. Aloes and other drugs acting upon the rectum should not be used. Loss of appetite or feeble digestion should be treated by stomachics. Cardiac disease or weakness causing passive congestion should be combated with cardiac tonics. Passive congestion due to obstructive disease in the liver should be controlled by the free use of saline cathartics, with an occasional mercurial purge.

The urine should be rendered as bland and non-irritating as possible. Hyperacidity should be controlled by regulating the diet and the giving of alkalis. In chronic cystitis the urine is usually alkaline, which reaction favors decomposition and bacterial growth. The alkalinity may be combated by using the mineral acids. Hydrochloric acid, alone or in combination with pepsin, may be used after meals. Nitric or nitromuriatic acid, combined with a vegetable bitter, is especially indicated when oxalate of lime crystals are present. Sulphuric acid, either the dilute or the aromatic form, has the greatest effect upon the reaction of the urine. Given in the form of a "lemonade," in which 5 to 15 drops of dilute aromatic sulphuric acid is used instead of lemon-juice, it makes a very palatable drink, and quickly renders the urine acid. Its long-continued use should be avoided. As soon as the reaction of the urine has been changed, boric acid or sodium benzoate, 5 to 15 grains t. i. d., should be substituted.

The urine may be rendered somewhat antiseptic, and its effects upon the mucous membrane of the bladder stimulating, by the use of the balsamic preparations. They are especially indicated when the urine contains thick, tenacious mucus and there is much irritation at the neck of the bladder. Sandalwood oil, 10 to 15 minims in elastic capsules or in emulsion after meals, or oil of copaiba, 5 to 10 minims, may be given. Frequently the combination of equal parts of oil of sandalwood and oil of copaiba is better borne. Saw palmetto, either in the form of the berries, 20 grains, or the fluidextract, ½ to 1 dram t. i. d., is given, not only to change the reaction of the urine, but also for the stimulating effect upon the circulation of the mucous membrane of the bladder.

To render the urine antiseptic, in addition to the balsams, salol, 3 to 5 grains t. i. d., boric acid, 5 to 10 grains t. i. d., urotropin, 10 to 15 grains t. i. d., or sodium benzoate, 10 grains t. i. d., can be used, either alone or in combination with the balsams. If these preparations cause disturbance of the digestion, their use should not be continued. If they do not in two or three days affect the frequency of urination, allay the pain, and diminish the amount of pus, they should not be continued. In very chronic cases stimulation of the mucous membrane of the bladder by the use of oil of turpentine, 5 minims every three hours, or cantharides, 1 minim every hour, until well-marked irritation of the bladder, as shown by increased urination and slight tenesmus, is obtained, has been advised for the purpose of causing a more active circulation. This plan of treatment is justifiable only in the absence of pain and where continuance of the cystitis is due to relaxation of the mucous membrane.

Local treatment of chronic cystitis consists in (*a*) drainage of the bladder, (*b*) irrigations, (*c*) instillations. When there is marked interference with the emptying of the bladder, or when irritation is so severe and the spasm so marked that the bladder is imperfectly emptied, and the condition cannot be controlled by medication or other local treatment, drainage of the bladder is necessary, not only for the cure of the cystitis, but also to prevent the progress of the septic process upward and involvement of the kidneys. Drainage may be intermittent or continuous. In milder cases the bladder should be thoroughly emptied at least once a day by catheterization, and after emptying thoroughly, washed out. In more severe cases continuous catheterization is necessary. A soft catheter of medium size is used, and in the case of patients with enlarged prostate, the Nélaton catheter. The catheter is introduced until the eye is just within the bladder. The catheter is retained in place by a string tied around it, the free ends of which are attached to a bandage or adhesive plaster attached to the sides of the penis. In continuous catheterization the bladder is washed two or three times a day with a mild antiseptic solution. It is necessary to remove the catheter and thoroughly cleanse it at least once in forty-eight hours. The presence of the catheter in urethra and bladder should produce but slight irritation. The pain caused by its introduction should rapidly subside, and it should relieve the tenesmus and other symptoms of vesical distention. When the instrument is introduced too far into the bladder, or has not been pushed far enough, it may increase the symptoms of bladder irritation. The catheter may be retained in the bladder from two to three weeks. From time to time the urethra should be thoroughly washed out with a mild antiseptic solution, so as to avoid urethritis.

In very severe cases, where vesical drainage is necessary but the catheter cannot be introduced or produces so much pain that it cannot be retained, suprapubic or perineal drainage may be necessary; or, in the female, drainage through the vagina.

Irrigations are used in chronic cystitis for the purpose of cleansing the bladder-walls of tenacious mucus, to prevent fermentation and ammoniacal decomposition of the urine, and to act directly upon the morbid process. It is impossible to use antiseptic solutions sufficiently strong to disinfect the entire mucous membrane. The irrigations are chiefly used for cleansing purposes, and the antiseptic used should not produce any irritation of the bladder-wall. The irrigating solution may consist of the normal saline; boric acid, 1:50; carbolic acid, 1:500; nitrate of silver, 1:1000; permanganate of potash, 1:2000 to 1:500; ichthyol, 1:200 to 1:50; or corrosive sublimate, 1:20,000 to 1:5000. When there is much pus, if strong alkaline solutions are used, the cells are broken up and a thick, gelatinous fluid results, which is very tenacious. The irrigation may be given either through a cone nozzle, as described in acute cystitis, or a soft-rubber catheter may be introduced directly into the bladder. In either case the bladder should be emptied thoroughly. The distention of the bladder should not be such as to produce pain. When the bladder is so sensitive that but small quantities of fluid can be introduced, instillation should be used instead of irrigation.

The number of irrigations per day depend upon the severity of the case and how well the irrigations are borne. In mild cases daily washing is generally sufficient. When there is very rapid decomposition or much purulent secretion, it may be necessary to wash the bladder two or three times a day. If catheterization is necessary to empty the bladder, a mild cleansing irrigation should be used at the time of each catheterization. In irrigation of the bladder the fact should not be lost sight of that this treatment should not increase the pain or tenesmus. When these symptoms are made worse under irrigation and the amount of mucus or pus steadily increases, the irrigations are contraindicated or have been given too strong.

In long-continued cases in which the circulation of the bladder is very sluggish, acute inflammatory reaction may be desired in order to change the nature of the process. This may be induced, after thorough washing of the bladder, by the introduction of a nitrate of silver solution, 1:500 to 1:50, according to the amount of reaction desired. This solution is allowed to remain in the bladder for one or two minutes and then washed out with a normal saline. In using stimulating irrigations the amount of irritation must not be so great as to cause the extension of inflammation to the ureters and kidneys.

Instillations are used when the irritability of the bladder is so great that irrigations cannot be used. Instillations are used chiefly when the inflammation is mainly at the neck of the bladder. The instillator may be a silver or hard-rubber catheter of No. 18 French caliber, attached to a hypodermatic or small glass syringe. The catheter is introduced until grasped by the compressor urethræ muscles, and the fluid is then injected. The solution may be of 5 per cent. nitrate of silver, corrosive sublimate, 1:5000 to 1:50, or iodoform emulsion, 1:10.

VESICAL HEMORRHAGE

The urine as passed may contain blood that is derived from the kidney, bladder, seminal vesicles, or urethra. The diagnosis of the source of the blood is made by taking into account all the circumstances attending its appearance. Frequently it is impossible to make a diagnosis without cystoscopic examination to determine whether the blood comes from the bladder or from other portions of the genito-urinary tract.

When the blood appears with the first of the urine passed, the rest remaining clear, it comes from the urethral canal; when the blood appears only at the end of urination, and especially when a few drops of blood follow urination, its source is generally from the neck of the bladder or from the prostate. In this condition there is apt to be frequent urination, pain, and tenesmus.

Vesical hemorrhage may be due: (*a*) To new-growths; (*b*) to calculus; (*c*) to ulceration, chiefly tubercular; (*d*) to traumatism; (*e*) to capillary hemorrhage from the sudden emptying of the distended bladder.

Vesical hemorrhage may occur during the course of infectious disease, scurvy, or purpura, or may be due to drugs irritating the mucous membrane, as cantharides.

The treatment of hematuria will depend upon the cause. When due to tumors of the bladder, the hemorrhage comes on without apparent cause, and is generally very profuse and uncontrolled by treatment.

In hemorrhage due to calculus there are generally more or less marked symptoms of chronic cystitis; then the hemorrhage occurs as a result of overexertion, or when the calculus has been carried to the neck of the bladder. Patients should be put to bed, the irritability of the bladder controlled by full doses of morphin, and the urine rendered mild by the use of diluent drinks. Subsequent treatment is that recommended for chronic cystitis, the most important feature of which is the removal of the calculus.

In hemorrhage due to ulceration the treatment is that of chronic cystitis. Beyond the treatment of the exciting cause, vesical hemorrhage may call for treatment on account of the presence of blood in the bladder. When it is clotted, causing overdistention, tenesmus, and pain, the distress should be controlled by a full dose of morphin, $\frac{1}{8}$ to $\frac{1}{4}$ grain, combined with atropin, $\frac{1}{100}$ to $\frac{1}{50}$ grain. The bladder should be emptied by a catheter of the largest size that can be introduced. When the blood is clotted, suction may be applied to the catheter. Pepsin and peptonizing solution to dissolve the clot should not be used; if necessary, the clot may be broken up by the introduction of a sterile sound. After the bladder has been emptied it should be thoroughly washed out with a hot astringent solution, as fluidextract of hydrastis canadensis, 1 ounce to 1 pint, 4 per cent. antipyrin solution, 1 : 5000 adrenalin chlorid solution, or 5 per cent. gelatin solution.

Hemostatics given by the mouth are of very little effect. Those most frequently advised are oil of turpentine emulsion, 3 to 5 drops; fluidextract of ergot, 1 dram; antiseptic ergot, 15 minims hypodermatically; gallic and tannic acid, 10 grains.

In persistent hemorrhage thorough cystoscopic examination of the bladder should be made in order to determine its nature and location. The patient should not be allowed to become anemic from the frequent losses of blood without every means being taken to determine its exact cause.

TUMORS OF THE BLADDER

Tumors of the bladder may be either benign or malignant. The benign tumors are papillomas or villous growths, myomas, fibromas, myxomas, and polypi. The malignant tumors are sarcomas and carcinomas.

The diagnosis of these different varieties cannot be made by symptoms. Cystoscopic examination aids in determining the location, and also to a certain degree the nature, of the growth, although in many cases it cannot be determined except by microscopic examination.

The treatment of tumors of the bladder consists in—(1) Palliative treatment for the control of pain; (2) treatment of the cystitis, hematuria, or interference with the emptying of the bladder. On account of the disturbed condition of the mucous membrane of the bladder, its resistance to micro-organisms is below the normal and it is necessary to avoid infection.

The introduction of instruments into the bladder should be done with great caution, on account of the liability of infection as well as the danger of traumatism. When infection takes place, the antiseptic solutions used should be of the mildest character. The treatment of pain and hemorrhage is the same as that described under "Acute and Chronic Cystitis" and "Hematuria."

When the tumor is so situated as to interfere with the emptying of the bladder, catheterization may be necessary. If it induces free hemorrhage or increases the pain or cystitis, it should not be continued unless surgical relief is impossible.

NEUROSES OF THE BLADDER

With the improvement in the methods of diagnosis and the introduction of the cystoscope many conditions that were formerly classified under neuroses of the bladder are now known to be due to definite pathologic changes in some portion of the genito-urinary apparatus, or to be dependent upon reflex irritation. Although there are conditions which are non-pathologic, the diagnosis of neuroses should not be made until all other causes are excluded.

Irritability of the Bladder.—This may occur as a constant and urgent desire to empty the bladder. Only a small amount of urine may be passed at a time, and micturition is very frequent; or the bladder is more tolerant, and only when it has been distended to a certain degree does the irritability show itself. In these cases after the bladder has been emptied there may be complete relief. In other types there is no urgency, and pain and tenesmus are present after passing the urine. The above types may occur as pure neuroses, but are more frequently symptoms of a localized cystitis.

The irritability of the bladder may occur intermittently in nervous patients under nervous excitement, fear, etc. In some cases there is an increased amount of urine and the symptoms are due to the polyuria.

Spasm of the Bladder.—Spasm of the bladder or "hysteric" bladder includes those cases in which the neurotic element is well marked and occurs intermittently. In many cases the frequent urination and pain whenever the bladder is slightly distended are the result of habit following some previous acute inflammation of the bladder or occur from nervousness. Many patients, especially women, give the history that the irritability has been present ever since an acute overfilling of the bladder from the polyuria of a nervous attack, and the habit of frequent micturition has been formed from the fear of a recurrence of the overdistention.

In the treatment of irritability of the bladder it is most important to determine the nature of the cause. When it depends on irritability of the nervous system, the antispasmodics and nervous sedatives are indicated, as the bromids, especially bromid of strontium, chloral or its derivatives, alone or in combination with the bromids. When the irritability is associated with pain, which occurs mostly at night, the use of a suppository containing ½ grain of opium or ¼ grain of extract of hyoscyamus at bedtime gives relief. The irritability due to changes in the amount of urine, as in diabetes mellitus, or in chronic or transient polyuria, or the increase in the urine at night from taking large quantities of fluid, especially beer and tea, is controlled by treatment of the cause of the polyuria. In many cases, especially in children, nocturnal polyuria can be controlled by abstinence from starchy foods and sugars at the evening meal.

Frequent micturition, with or without pain, may be due to changes in the composition of the urine. Cantharides, quinin, or soda salicylate, taken as medicine, radishes in excessive quantities, spices, and turpentine, either inhaled, as by painters, or ingested as a medicine, may irritate the bladder. Marked hyperacidity of the urine, crystals in the urine, or a specific gravity that is too high or too low may be the disturbing factors, and should be treated accordingly.

Reflex irritation—(1) From other portions of the genito-urinary tract; (2) from the rectum, as pin-worms, fissures of the anus, etc.; (3) from the pelvic organs or from peritoneal adhesions, should be sought for, and if present relieved.

Pressure on the bladder from a prolapsed uterus or distended colon causes frequent micturition. Extreme spasm of the bladder may occur as a symptom of disease of the nervous system, especially locomotor ataxia.

When the irritability is dependent upon a local cystitis, it is necessary to treat it by irrigations or instillations, as described under "Acute and Chronic Cystitis."

There can be no routine treatment for bladder irritability. Each case should be carefully studied in order to determine both the predisposing and exciting cause. Much harm has been done by considering every case a neurosis that does not show well-marked symptoms or the urinary findings of some form of cystitis.

Tuberculosis of the bladder may for a long time give only frequent or painful urination. Cystoscopic examination should be made in every case of bladder irritability that persists.

Incontinence of Urine.—Incontinence of urine is the passing of urine unconsciously, due in most cases to a disturbed or faulty innervation of the bladder. In children up to eighteen months or two years of age incontinence is normal. Generally by three years of age urination is under the control of the will, both day and night. The age at which the normal infantile incontinence ceases and completeness of control, both day and night, occurs, is largely a matter of training, but to a certain degree is temperamental also. Nocturnal incontinence is apt to persist the longest. Both day and night incontinence may be intermittent. In some children the attention is so engrossed in play during the day that they pay no attention to the desire to urinate, and the bladder suddenly empties itself. These children may be perfectly continent during the night. Incontinence occurs during the night in children who sleep too soundly to be aroused by a desire to urinate. In other children the sleep is easily disturbed, the child is restless, and the amount of urine is markedly increased at night. There is a veritable polyuria, which may be due to the condition of the nervous system, to the quantity of fluid taken late in the afternoon and before retiring, or to the taking of a large amount of carbonaceous food and sugars with the evening meal.

Nocturnal incontinence may be due to disturbed nervous mechanism of micturition. The irritability of the bladder muscles may be increased, while control by the sphincter is below normal. The irritability of the bladder may be increased by reflex irritation from other portions of the genito-urinary tract, especially adherent prepuce, balanitis, narrow meatus, and mild forms of cystitis or calculus; by urine that is too acid or contains crystals; or by reflex irritation from the rectum, especially pin-worms, fecal accumulations, rectal polypus, or fissure of the anus.

In the adult incontinence may have persisted since infancy. When it occurs intermittently, it may be a symptom of hysteria, neurasthenia, or epilepsy. In every case of incontinence in the adult that occurs after puberty the possibility of it being due to an epileptic seizure should be kept in mind.

Treatment.—Incontinence of urine is sometimes very easily controlled, or it may persist in spite of all treatment. As in irritability of the bladder, so in incontinence of urine, it is necessary to seek for the cause or causes, as frequently several factors are present. Every condition that is likely to cause irritability of the bladder should be removed. The mode of life should be carefully regulated; special attention should be paid to the diet, to the character and amount of food taken at different times of the day, and to the quantity of liquid taken late in the afternoon or before retiring. Especially important is the knowledge of the amount of nervous excitement the child is under during the day. In many cases this is so great that by night the nervous system is thoroughly exhausted, and either the child sleeps too heavily to be aroused by the desire to urinate, or it is restless and there is general increase of irritability of the nervous system. When incontinence occurs during the day, the child should be corrected for it; when it occurs at night, punishment does no good and often acts badly.

Belladonna, hyoscyamus, and strontium or their alkaloids have been most used to control the bladder irritability, especially when due to increased irritability of the nerves of the muscles of the bladder and of the sphincter. The drugs should be given until their full physiologic action is obtained. Children bear belladonna or atropin much better than adults, as their hearts are not affected as readily, and therefore larger doses can be given to influence the bladder without causing unpleasant cardiac symptoms. It is best to begin with small doses and gradually increase. Holt advises that the solution of atropin be 1 grain to 2 ounces,—one drop equals $\frac{1}{1000}$ of a grain,—and that one drop be given for every year of the child's life; that the medicine be given at 4 and 10 P. M., and after a few days at 4, 7, and 10 P. M. While it has been claimed that for a child ten years old it has rarely been necessary to give more than $\frac{1}{100}$ of a grain, still cases do occur in which doses of $\frac{1}{50}$ of a grain must be given before the desired effect is obtained. How long the drug should be given varies with the individual case; generally there is some improvement in a few days.

When the condition is not controlled, even though full physiologic effects of the atropin are obtained, the drug should be stopped, as it is not indicated in that case.

If the atropin controls the condition, it should be continued for some months in order to break up the habit of the bladder of emptying itself whenever it has become slightly distended.

In cases not controlled by belladonna, 10 minims of rhus aromaticus should be tried. When the incontinence is due to a want of control by the sphincter muscle, drugs should be given which cause a slight increase of irritability of the neck of the bladder. Quinin, either alone or in combination with antipyrin, frequently controls it, or the use of tincture of nux vomica or strychnin. When the incontinence is due to general irritability of the nervous system, bromids or chloral, either alone or in combination, are indicated. Strontium bromid is the best preparation, as it does not disturb the stomach or depress the patient; 5 to 10 grains may be given to the child during the day, combined with some of the pepsin preparations. If the child is a poor sleeper and restless at night, small doses of chloral, 2 to 4 grains, or one of the chloral derivatives,—veronal, 2 grains; trional, 3 to 5 grains; sulphonal, 2½ grains,—may be given at bedtime.

Electricity has been used to control the condition. The positive pole of a small electrode is passed into the rectum, and the negative pole is applied over the bladder. A mild faradic current is used. The positive pole may be placed on the perineum and the negative pole over the pubes when it is desired to introduce the positive pole into the rectum.

Local treatment by the introduction of sounds or fluid into the bladder should not be used until all other means fail and there is evidence of some localized cystitis.

Retention of Urine.—Retention of the urine is due to inability to empty the bladder. (1) It may be due to loss of muscular tone of the bladder, due to paralysis of the muscles dependent upon degenerative changes in the motor column of the spinal cord, as locomotor ataxia, transverse myelitis, Pott's disease, general paralysis, sclerosis, cerebral and spinal injury. (2) The muscles of the bladder may be paralyzed by acute or chronic overdistention, or by inflammation extending from the mucous membrane or from the peritoneal covering. (3) Obstruction to the flow of urine, which may be—(*a*) organic, as enlarged prostate, stricture of the urethra, impacted calculus, or (*b*) spasmodic contraction of the sphincter muscle, due to inflammation of the neck of the bladder or the prostatic portion of the urethra, or to reflex irritation from other portions of the genito-urinary tract or from the rectum.

The treatment of retention of urine depends upon the nature of the cause. When due to lesions of the spinal cord, it is incurable, although strychnin, electricity, and counterirritation may give temporary improvement at the start. The treatment of retention due to organic obstruction has been already described under "Acute and Chronic Cystitis." Treatment of retention due to spasmodic stricture of the bladder depends upon the cause. When dependent upon increased irritability, the treatment should be that outlined in considering irritability of the bladder.

SURGICAL INDICATIONS IN URINARY TRACT DISEASE

By Guy L. Hunner, M.D.

Introduction.—Within the limits set for this section one cannot possibly treat in a comprehensive manner the urinary tract diseases which may become surgical in their nature.

It often happens that the making of a correct diagnosis gives to the surgeon his most interesting hours, and to the patient, the most important factors in the successful conduct of his case. This is particularly true in dealing with urinary tract disease.

The wonderful progress of the past quarter of a century in the therapeutics of urinary tract diseases has been largely due to better diagnosis. Our advances in diagnosis have been chiefly along two lines: First, the better use of methods already well known, such as history-taking and accurate examination of the urine; second, the development of new instruments of precision, such as the cystoscope, the renal catheter, and the Röntgen-ray apparatus.

So far as is consistent, this section will omit the wider aspects of etiology, classification, pathology, and diagnosis, and treat only of the surgical indications in urinary tract diseases, including under surgery all manipulations not purely medical.

SUPPURATIVE DISEASES

Pyelitis.—An acute or chronic inflammation of the kidney pelvis.

In dealing with surgical inflammations of the kidney we generally have in mind those caused by microbic infection. While the pyelitis or pyelonephritis due to acute exposure to cold or to the action of irritant drugs may be accompanied by infection, they are usually aseptic and purely medical conditions.

Pyelitis is usually monolateral, and arises most frequently during the mid-months of pregnancy or during the puerperium. Operation for suppurative processes elsewhere in the body is occasionally followed by pyelitis, the local signs and symptoms occurring first on one side and then often becoming bilateral.

Partial obstruction to the ureter is a fertile source of the condition, as demonstrated by the pregnancy cases, by those due to an enlarged prostate, or to any tumor or inflammatory process in the pelvis or abdomen displacing or compressing the ureter, and by those associated with floating kidney, with the consequent ureter kink.

Infected urine, with symptoms of cystitis, pyelitis, or pyelonephritis, is occasionally seen to occur intermittently in patients subject to intestinal disorders. These cases generally show a colon bacillus infection, but are easily controlled by medical and hygienic measures. (For a comprehensive view of these measures see Dr. LeFevre's section.)

Pyelitis as a sequel of gonorrheal urethritis and cystitis is rare, and if the inflammation has become chronic, the urine may be sterile or contain a secondary colon bacillus infection. Pyelitis may accompany a chronic Bright's disease, in which case, in addition to the usual features of pus, epithelial cells, and bacteria of the pyelitis, the urine shows casts and more albumin than is usual in pyelitis.

Chronic pyelitis may exist for years without appreciable symptoms or ill effects on the patient's health.

Surgical Treatment of Pyelitis.—Rarely need a case of pyelitis become the subject of surgical treatment with the knife. In the cases complicating pregnancy the indications are the administration of large quantities of water by mouth, rectum, or subcutaneously; rest in bed, using posture in a way to drop the uterus away from the compressed ureter, or the prone or sitting posture, if both sides be affected; and the administration of alkalis if the urine be acid, or of acids if the infection be by an organism growing best in an alkaline medium. One of the hexamethylenamin products, such as urotropin, cystogen, or formin, is generally used in these acute infections, but the author has noted clinically and taught his students that if the infection is not controlled by this drug within a week or ten days, it is useless to continue with its administration.

My colleague, Dr. C. F. Burnam, has recently been working on the quantitative elimination of formalin, and finds that only about two patients out of ten break up the hexamethylenamin into a sufficient quantity of formalin to act as a disinfectant in the urine. There is a distinct tendency to self-limitation in this disease, the acute symptoms usually subsiding in from one to two weeks and the urine becoming clear somewhat later. If these simple remedies are not followed by prompt relief of symptoms, and later clearing of the infection, the infected pelvis should be catheterized and irrigated by a 1:1000 silver nitrate solution on alternate days until the infection is controlled. If the symptoms are of particular severity, a small renal catheter, No. 5 French, may be left in one or both kidneys, and a frequent irrigation of 1:3000 silver nitrate solution be given; or a continuous salt solution, boric solution, or weak silver solution, 1:10,000, may be instituted and carried on indefinitely until the symptoms subside.

With our present methods of cystoscopy pyelitis will seldom justify a termination of pregnancy. In those cases in which the infection persists until after term, and in the cases becoming infected during the puerperium, the pyelitis tends to become chronic. The patient may be entirely free from symptoms for weeks at a time, and have intermittent attacks of chill and fever, with nausea and vomiting, prostration, local pain in the kidney region, and bladder symptoms.

The infection in these cases is usually by the Bacillus coli, and it occasionally disappears on the administration of one of the formalin preparations. If it does not disappear within ten days with this treatment, one may be certain that further treatment by this means is futile.

In those cases which may be said to have become chronic the author has had uniformly good results by lavage with the silver nitrate solution. The kidney is catheterized with a small catheter, No. 5 or 6, so the irrigating fluid will easily flow back to the bladder. With a two-way glass syringe holding 15 c.c., silver nitrate solution of 1:1000 strength is pumped into the kidney pelvis rapidly enough to cause a feeling of fullness in the side. Four syringe-barrels of 15 c.c. each are used, and this is followed by one barrel of boric solution or salt solution, to rid the pelvis of any possibility of inflammation from the silver.

If the solution does not easily return past the catheter, the syringe is repeatedly disconnected for a back flow through the catheter as soon as the patient complains of the pressure feeling. Care is used not to carry the pressure to the point of pain; these treatments are given as office routine, and the patient is allowed to return home.

It has been customary to warn patients who have had one attack of pyelitis of pregnancy never to become pregnant again. It is difficult to see the logic of such advice, and the future watching of such cases will probably show that it is not well founded. Naturally, a case complicated by Bright's disease will have to be advised according to the individual conditions, and she would undoubtedly be more likely to develop an infection of the pelvis during pregnancy than the average pregnant woman.

The post-operative pyelitis infections usually clear up under hygienic and medicinal measures, to which is added, with apparent benefit, the frequent application over the loins of hot fomentations or poultices; but in the more serious or protracted cases the irrigations through the renal catheter should be instituted.

Acute Pyelonephritis.—This condition, in which both the pelvis and kidney parenchyma become the seat of acute infection, is comparatively rare, but presents some of the most formidable surgical problems in the treatment of the kidney. The question as to whether the infection is of hematogenous origin, first causing septic infarct of the kidney, or of ascending origin, causing pyelitis, followed by the more diffuse type of infection, is important only as it relates to the original focus of infection, and for the possible bearing of this knowledge on the line of treatment.

The acute kidney infections associated with the acute infectious fevers, such as typhoid and pneumonia, and those associated with endocarditis and pyemic conditions, should be treated expectantly in most cases. Those associated with tonsillitis, parotitis, and carbuncle are likely to be staphylococcus or streptococcus metastases, and form the most severe type of hematogenous infections. Fortunately, the kidney symptoms are likely to occur after the height of the original infection, and can, therefore, be dealt with independently.

The kidney infections following an old cystitis, prostatitis, urethral stricture, or other obstruction to free ureteral drainage are usually of ascending origin, either through the urinary stream or via the lymphatics. Manifestly, each of this class will present problems that must be met in deciding upon the form of kidney treatment.

Statistics as to the frequency of monolateral and bilateral pyelonephritis vary considerably. Autopsy records show that the disease is bilateral, in the large majority of cases, and this corresponds with the clinical and experimental demonstrations that with one kidney diseased the other is prone to become so. It is probable that in many cases there is an interim of some days between the infection of the first and second kidney, and this should be the most effective time for surgical treatment.

With present-day methods of early examination of the urine and of accurate determination of kidney conditions by cystoscopy, catheterization, and functional tests, we are in a position to make an early differentiation of kidney infections from diseases of the other organs. We can determine whether the infection has involved one or both kidneys, and we can gain some knowledge of the working value of each kidney. The functional tests in these acute inflammatory conditions should be interpreted with caution and in the light of all the data obtainable.

With this knowledge, the adherents of the two different methods of surgical treatment—nephrotomy with drainage versus nephrectomy—will have an opportunity for early action, and within a few years we should have statistics of value, because the different lines of action have been applied to similar antecedent conditions.

The author favors nephrotomy with drainage. While this does not reach and drain all the suppurative foci, it relieves intracapsular tension, favors drainage of the urinary tubules, and, above all, improves the circulation, thereby aiding nature in the restorative processes which are sometimes successful even without operation.

Should the suppurative process have reached the abscess stage and have destroyed most of the kidney, nephrectomy should be done if the patient's physical condition permits, and providing preliminary examination has shown the patient to possess another kidney, and this to be in fair condition.

If the pyelonephritis is due to stricture of the ureter, stone in the kidney, ureteral fistula, or any similar condition that cannot be corrected easily, the operation should be nephrectomy, providing the other kidney is healthy and in no special danger of similar conditions arising.

Bilateral infection, if a surgical proposition at all, certainly calls for nephrotomy and drainage. In either monolateral or bilateral nephrotomy with drainage nephrectomy on one side may be done later if the conditions so indicate.

If the infection calling for monolateral or bilateral operation should be due to an enlarged prostate, stricture of the urethra, or any condition promising a continued obstruction to the ureter drainage, the indication may be to drain the bladder by posterior urethrotomy or suprapubic cystotomy until the primary cause of trouble can be corrected.

The operation of nephrotomy with drainage in cases of pyelonephritis is not without its immediate dangers. The kidney may be so large and congested that it is difficult to determine the presence of pus foci, and while operating, one is sometimes tempted to alter the diagnosis to tumor of the kidney, and then to proceed with nephrectomy. Nephrectomy should never be done without knowing the condition of the other kidney, for a large kidney of this description may be one of compensatory hypertrophy, due to absence or disease of the other kidney.

The large size of the kidney may make it difficult to deliver the organ through the lumbar wound, and the congested condition often results in frightful hemorrhage when making the nephrotomy opening. In exceptional cases the infection seems confined to one pole of the kidney. This pole may be excised, but in such event no attempt should be made to close the pelvis or cut parenchyma. The bleeding should be controlled by twenty-day catgut passed through the cut edges of the kidney as a square or mattress suture, on a blunt-ended round needle, and free drainage should be instituted to the kidney pelvis.

In most cases the kidney should be opened from end to end. By following a line one centimeter posterior to the summit of the convex border, and by separating the parenchyma with a blunt instrument, a silver wire, or the finger-edge, cutting from the pelvis outward through the parenchyma, a minimum of bleeding results. This, however, may be excessive, and too persistent to be controlled by packing. All active vessel ends should be separately controlled by ligature before instituting the drainage. In the friable condition of the tissues of the kidney it is usually impossible to make satisfactory free end ligation, and one must pass whipped sutures superficially through the tissues on two sides of the vessel end.

Pyonephrosis.—The indications for treatment in the case of a dilated infected kidney pelvis depend largely upon the antecedent conditions.

If the case is monolateral and of long standing, and if cystoscopy, catheterization, mensuration, collargol, *x*-ray, and the functional test show practical destruction of the kidney parenchyma, nephrectomy is indicated, providing the investigation shows one sufficient kidney. The surgeon is sometimes called upon to treat a case of pyonephrosis away from home, or under circumstances precluding preliminary examination of the two kidneys. Under such circumstances nephrotomy is the operation of choice. Nephrectomy may be done later, after investigation of the renal function, or the patient may choose to bear the inconvenience of a renal fistula. Should there be no ureter obstruction, the fistula may heal and pyonephrosis may again appear. The surgeon has now had time for investigation of the renal function, and knows whether nephrectomy is safe.

A floating kidney, with hydronephrosis which has recently become infected, may have the pyonephrosis cleared, the kidney well fixed, and comparatively good function restored by simple nephrotomy and drainage. A retention rubber drain may be utilized for frequent irrigation of the kidney pelvis, and after closure of the wound, kidney catheterization and irrigation with the silver solution, as for pyelitis, have resulted in a complete clearing of the infection.

In cases of pyonephrosis due to a removable obstruction, such as stone in the ureter, enlarged prostate, or a tumor pressing on the ureter, if preliminary examination shows fair working capacity of the kidney, rational therapy calls for removal of the obstruction and subsequent lavage treatment.

Manifestly, the lavage treatment promises better results in the recently infected case of hydronephrosis than in a chronic pyonephrosis, and permanent results should not be expected unless all obstruction to free ureter function can be removed.

Perirenal Abscess.—Perirenal abscess is a surgical disease, irrespective of its etiology. The day for expectant treatment of perirenal abscess due to traumatic laceration of the kidney has long since passed. The local and medical treatment of perirenal inflammation or cellulitis that has not progressed to abscess formation is treated of in the preceding section.

When operating to drain a perirenal abscess, the surgeon should ascertain, if possible, the exact point of origin, in order to control the nature and extent of his primary operation, and to enable him to map out the probable future course of events.

A perirenal abscess due to traumatic laceration of the kidney substance or of the ureter may call for a nephrectomy. A careful study of the field may lead to such intelligent drainage of a ruptured ureter or kidney that the organ is permanently saved. Stone high in the ureter or stone in the kidney should be removed at the primary operation unless the patient's condition contraindicates. If the abscess is found to have its origin in the bone, in the pleura, in the gall-bladder, intestine, or appendix, the surgeon is equipped with valuable knowledge for further treatment of the patient.

TUBERCULOSIS OF THE URINARY SYSTEM

Excluding venereal infections and their sequelæ, calculus and tuberculosis are the most frequent urinary tract diseases.

While calculus presents some of the most intricate problems in diagnosis and treatment, the indications in tuberculosis may be said to have become fairly well established.

With comparatively few exceptions, in which the disease is primary in the genital organs of the male, tuberculosis of the urinary system may be considered as primary in the kidney. In 90 per cent. of the cases it is monolateral in origin. In a large percentage of cases it becomes bilateral if untreated. In 80 per cent. of the cases tubercle bacilli can be demonstrated microscopically, and in most of the remaining 20 per cent. the guinea-pig test is positive.

The indications are, therefore, plain. Tuberculosis of the kidney should have an early diagnosis and an early removal of the affected kidney.

This section is not intended to deal with problems of diagnosis, but inasmuch as early diagnosis is of such importance in the successful treatment of this disease, a few aphorisms, well recognized among urologists, but not yet grasped by the profession at large, may profitably be noted.

Irritable bladder is the first and only symptom in many cases of tuberculosis of the kidney.

A tuberculous kidney may progress for months or years, and even become destroyed, without appreciable signs or symptoms in the kidney region.

In any supposed case of cystitis with pus in the urine, in which the symptoms fail to yield to cystitis treatment within the period of one month, tuberculosis should be strongly suspected and carefully looked for. In an occasional case of this description stone in the kidney will be revealed.

In any case with cystitis symptoms and a bladder specimen of urine showing pus or pus and blood, if the cystoscope shows a normal bladder, tuberculosis of the kidney should be looked for. If with such signs and symptoms cystoscopy reveals a slight blush of red or an edema of the mucosa about one ureteral orifice, or this meatoscopic picture, together with one or more isolated areas of congestion in an otherwise normal-looking bladder, the presence of a tuberculous kidney is strongly probable.

Secondary involvement of the ureter is a common sequel in untreated kidney tuberculosis. Any gross enlargement of the lower end of the ureter as palpated through the bowel or vagina should be considered tuberculosis until it is proved by the wax-tipped catheter or the Röntgen ray to be the seat of stone. In one case of tuberculous ureter the author got distinct scratch-marks on the wax-tipped catheter. These were probably due to deposits of urinary salts on the ulcerated ureteral mucosa. Occasionally gross enlargement of the lower ureter is palpated in a case of stricture not dependent on tuberculosis or stone.

The use of tuberculin is helpful, but not positive, because of a possible tuberculous lesion elsewhere in the body.

The only positive diagnosis is the demonstration of tubercle bacilli in the urine by means of the microscope or the guinea-pig test, but the surgeon of experience is able to reach a conclusion justifying the radical operation without actual demonstration of the bacilli.

Surgical Indications.—As before stated, the indications are usually simple—early diagnosis and early removal of the diseased kidney. The consultant is often tempted to grant the patient a few months or years for trial of climatic and medical treatment. The result of experience is strongly against this delay, even if the patient is well-to-do and can command the best of hygienic surroundings.

If the patient has a two-sided infection of equal degree, the climatic treatment should be advised. If, with a bilateral infection, one kidney is giving serious symptoms and doing but little work, and the other kidney is demonstrated to be the seat of fairly good function, this best kidney is usually found to increase its function after the removal of the more diseased member. The use of tuberculin as a therapeutic measure in cases of bilateral renal infection and in chronic tuberculous cystitis has not given results of sufficient uniformity to warrant a statement as to its value.

Experience is strongly against partial resection of a tuberculous kidney. If the process is seen to be coming from without the kidney, as from a tuberculous process in the bone, appendix, or intestine, and has involved but one pole of the kidney, partial resection with free drainage is indicated.

In double kidney and double ureter, where one can demonstrate one section to be tuberculous and the other healthy, only the tuberculous section should be removed.

In some long-standing cases the patient comes to the surgeon with a history of bladder symptoms and more or less discomfort in the region of one kidney, extending over a period of months or years, and says that discomfort in the other kidney has begun within a few weeks. Examination reveals thickening of both ureters, usually more marked on the originally diseased side. The renal catheter may easily pass through this most diseased ureter, while it will pass with difficulty or not at all in the recently involved side. The urine from the originally diseased side may consist largely of pus and detritus, and show that kidney to have very little functional capacity. Myriads of tubercle bacilli may be demonstrated from this side.

If the catheter will pass to the more recently affected side, or if the urine from this side be collected through the bladder while the renal catheter remains in the more diseased kidney, the urine may be found turbid, but of much better quality than from the opposite side, and it may contain a comparatively few or no tubercle bacilli.

The author has had four such cases of apparent recent ascending involvement of the second ureter and kidney pelvis. The poorer kidney was removed in each case. A vesicovaginal fistula was made in two of the cases, because of the extreme involvement of the bladder. In these two, and in a third case without vesicovaginal fistula, the bladder and ureter disease finally cleared up and the kidney secreted normal urine. In the fourth case, operated less than one year ago, the patient's letters would indicate a progress of the disease on the remaining side.

Treatment of the Tuberculous Ureter.—If preliminary investigation or examination at operation shows a thickened ureter, this organ should be removed.

Should the patient be advanced in years or in depleted general condition, or if the removal of the kidney has been a difficult or prolonged operation, or accompanied by much hemorrhage, conservatism does not allow removal of the ureter at the original operation.

It is rare that a diseased ureter causes serious after-trouble demanding a second operation.

If the ureter is removed at the first operation, it is best to make a second incision—either a low McBurney or a low rectus muscle incision, keeping outside the peritoneum. The ureter will best be located as it crosses the pelvic brim, and it is always found adherent to the peritoneum. It is more easily located if a few quick jerks be transmitted to it by an assistant tugging on a ligature previously tied about its upper end, carried out of the lumbar or kidney wound, and secured by a clamp. When the ureter is densely adherent to the iliac vessels as it crosses the pelvic brim, it is often difficult to free from the vessel sheath, and particularly from the peritoneum on the ventral side. To prevent tearing the peritoneum it is often advisable to incise the periureteral sheath, and by blunt dissection to skin the ureter out of its sheath.

While working on the pelvic portion of the ureter, it is of great advantage to have the patient in the high elevated pelvis position.

In women the writer has occasionally resected a portion of the bladder-wall and removed it with the ureter. To do this the uterine vessels are held forward with a narrow, blunt spatula, and the cone of bladder is drawn up by traction on the ureter. Interrupted catgut sutures may be passed through the bladder-walls before resecting the cone, thus simplifying the closure of the bladder in the necessarily deep operation wound.

Whether the thickened ureter stump is tied and cut just above the uterine vessels, or whether the bladder-wall is resected as above, one leaves as drainage from one to three finger drains of iodoform gauze wrapped with rubber tissue. In either case only catgut is used as suture or ligature material, and in either case one occasionally gets a temporary urinary fistula after absorption of the catgut. A tuberculous sinus of several months' duration is not uncommon.

Should the tuberculous ureter be left *in situ*, its upper end may be elevated to the skin of the lower end of the kidney incision and there sutured. Through this ureteral sinus a tuberculous bladder may be conveniently treated, the antiseptic solution being beneficial to the ureter at the same time. Should the ureter be too thickened and adherent to be brought to the skin surface, drainage is instituted and a tuberculous sinus forms from the upper end of the ureter to the skin. This may likewise be used as an irrigation tract in treating the bladder. Such a sinus usually remains patent for a few months, and it may persist for two or three years, at times closing at the surface, only to open again within a few days or weeks. It rarely causes more local trouble than the inconvenience of dressing the lumbar wound.

The effect on the bladder symptoms of leaving a tuberculous ureter is of far more importance. The ureter has been seen to undergo peristaltic waves at a long period after removal of the kidney, and the author's experience leads to the belief that the tuberculous ureter may, by its peristaltic activity, aggravate the serious bladder symptoms for a long time. Accurate conclusions on this point cannot be drawn, for one often sees serious bladder symptoms persist for from one to three years after the entire ureter has been removed, and even in cases where the only visible focus of disease is in the vertex of the bladder.

Treatment of the Tuberculous Bladder.—At one time in the author's experience he expressed serious doubt as to whether a tuberculous lesion in the bladder could be cured by other method than resection.* Since then his own experience and that of others has shown that, with time and patience, practically every case of tuberculous cystitis will result favorably after the removal of the tuberculous kidney. This statement applies to those patients who have no other active focus of tuberculosis. When the patient has to combat with other foci of tuberculosis, the bladder lesion is extremely slow in reacting to treatment.

Bladder ulcers at a distance from the tuberculous ureter should not be resected at the time of the nephro-ureterectomy, for they are often of a non-specific character, and quickly heal spontaneously after removal of the kidney.

The surgeon is occasionally surprised, after nephrectomy, at the early cessation of symptoms and rapid healing of the bladder, even when the ureter is thickened and the bladder mucosa shows inflammation about the ureteral orifice. We know, from microscopic studies, that a tuberculous kidney may be associated with a non-tuberculous thickening of the ureter and inflammation of the ureterovesical region. It is probable that most, if not all, of the rapidly healing cases of apparent tuberculous ureter and bladder belong to this group. It is likewise probable that most cases of tuberculous ureteritis and cystitis will heal spontaneously after removal of the tuberculous kidney, providing the patient has no other active focus of tuberculosis, and granting that he can command conditions favorable to general good health. It is certain, however, that the recovery of tuberculous cystitis may be hastened by appropriate local treatment.

The silver salts, so useful in most cases of cystitis, are generally recognized as harmful in tuberculous cystitis. Oil emulsions of iodoform have been used, with apparent success. Lactic acid has been used with good effect (Witzack), but its use as an instillation is said to be extremely painful. Rovsing recommends carbolic acid in 6 per cent. solution, 50 c.c. being left in the bladder for three or four minutes. Gomenol oil, a distillate from the leaves of a species of

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*See Hunner, "Surgery of Urinary Tuberculosis in Women," American Medicine, 1904, vol. vii, p. 701.

Melaleuca viridiflora, compounded in various strengths with pure olive oil, has recently been highly lauded in Europe and America, and it seems to have specific action on the tuberculous process.

The writer prefers the use of instillations of bichlorid of mercury. Some of the European urologists recommend its use in the stronger solutions at first, beginning with the 1:2000 solution and using morphin for the control of pain. As the process improves the strength of the instillations is lowered.

There is no question but that these very strong solutions are beneficial, but one rarely finds an American patient with the hardihood to submit to a second treatment with bichlorid of such strength. Two of the author's patients have received an instillation of 1:1000 bichlorid of mercury by mistake, with a resulting hemorrhagic cystitis necessitating several days in bed and the frequent use of opium. The ultimate reaction was one of great improvement in the tuberculous bladder, but each patient was quite content to travel a slower road with the weaker solutions.

The author prefers beginning with a 1:10,000 solution of the bichlorid of mercury, and if this is well borne, rapidly to increase the strength to 1:5000. Very few patients will tolerate a stronger solution. About one ounce is given twice a week, and the patient is asked to retain the solution as long as possible before voiding.

In some extremely sensitive bladders the treatment has to be carried on for some weeks with a solution of 1:100,000 or even weaker before the patient can tolerate increasing strengths.

Gomenol oil in 20 per cent. strength is a most grateful instillation to these sufferers, but the author has not had sufficient experience to warrant a comparison of its curative value with that of the mercury. Used as a daily instillation of from 15 to 30 c.c., its symptomatic results are praised by most patients.

In the cases of tuberculous bladder showing general ulceration or inflammation and a marked degree of contraction, the author prefers placing the bladder at rest by making a fistula. This is a simpler proposition in women than in men, because a vesicovaginal fistula can be made. After making the fistula, regular biweekly instillations of the bichlorid solution are given, and the patient takes whatever posture experience teaches is most favorable for the retention of fluid in the bladder.

It has not been necessary to continue a fistula longer than one year. While the bladder may still show inflammatory areas, it is sufficiently improved to warrant its closure and the continuance of the instillation treatment under the more normal conditions.

These artificial vesicovaginal fistulas are easily closed without giving a general anesthetic. A hypodermatic injection of morphin, $\frac{1}{6}$ or $\frac{1}{4}$ grain, is given, and 1 per cent. cocain solution is injected about the fistula edge. The rim of the fistula is excised, leaving fresh edges on both bladder and vaginal mucosa. Through-and-through sutures of pure silver wire, fine enough to tie easily, are set close enough so that the fistula does not leak when the bladder is overdistended with salt solution at the close of the operation. These sutures are removed on about the tenth day. After closure of the fistula the patient is allowed to be about, leading a normal life from the moment of operation.

SURGICAL ASPECTS OF CHRONIC CYSTITIS

Acute cystitis has been considered in the section on the Medical Aspects of Urinary Tract Disease.

It must be remembered that many patients suffering with the most severe symptoms of chronic cystitis have no cystitis at all. One important class, the tuberculous kidney cases, often presents all the classic symptoms of chronic cystitis, viz., urgency of urination, pyuria, and pain; but the cystoscope may show a perfectly normal bladder mucosa, or simply a slight puffiness or redness about one ureter orifice. In a second important class, the post-gonorrheal cases, the symptoms of urgency, frequency, and pain may be marked, while the urine is normal or contains an excess of mucin and epithelial cells, and the cystoscope shows trigonitis and urethritis.

Many of the so-called "neuroses" of the bladder belong to the old gonorrheal trigonitis and urethritis group, and become surgical only in the treatment of these chronic conditions. Many others belong to the chronic urethritis group, due to toxins from chronic tonsillitis, and extirpation of the tonsils stops the bladder "neurosis."

Surgically speaking, chronic cystitis cases fall into two groups, if we rule out tuberculous cystitis, treated of in the previous section, and some of the very rare diseases, such as syphilis of the bladder and cystitis Bilharzii.

The first group comprises those cases which, so far as we can see, depend simply upon an infection of the urine and bladder walls, and these rarely require radical surgical treatment. Free ingestion of water, antiseptics by mouth, and antiseptic irrigations or instillations will usually control these cases. In some obstinate cases of chronic ulcer more radical measures are necessary, such as curetage or application to the ulcer of strong caustics. Silver nitrate solution, in 10 or 20 per cent. strengths, lunar caustic, or pure carbolic may be used, and when these fail, the use of the actual cautery is sometimes successful.

In some of the most obstinate cases, particularly in those with deposits of urinary salts over the surface of the ragged ulcer, it becomes necessary to institute drainage by cystostomy, and the healing is hastened by the use of a continuous irrigation.* In women a vesicovaginal fistula may be made under local anesthesia, and closed under the same anesthetic measures. (See Treatment of Tuberculous Cystitis.)

The second group comprises those cases in which the cystitis is dependent upon some remote cause, such as a foreign body or a mechanic obstruction which has to be removed surgically before the cystitis will yield to the simpler forms of treatment.

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* See Hunner: "The Tub-bath Treatment of Cystitis," Jour. Amer. Med. Assoc., 1907, xlix, 2066.

Congenital loculate or sacculated bladder and sacculated bladder due to spinal cord disease belong to this class; and when an infection leads to stone formation in the loculi, the stones, if small, may be displaced and removed by use of the operating cystoscope, or by combining litholapaxy, and the ulcerated pocket may be treated by local application through the cystoscope. If the diverticulum be large and deep, its operative removal may be indicated. The prognosis in the spinal cord cases is bad, and the more radical measures are contraindicated.

In chronic cystitis due to bladder tumor, stone, or other foreign body, or to stone developing about a ligature following a former operation, the indications for surgical treatment are plain.

In the cases due to mechanic obstruction, such as stricture of the urethra in either sex, enlarged prostate in the male, or to cystocele in the female, the original cause must be treated or removed, or if this be impossible, cystostomy may be indicated as a temporary or permanent measure.

Infiltrating carcinoma sometimes resembles chronic ulcer; therefore, when a chronic ulcer fails to yield to systematic treatment, a small section of the base should be removed by the alligator scissors or curet, and submitted for microscopic diagnosis. The curet should never be used immediately about the ureteral orifices because of the danger of ascending kidney infection.

URINARY CALCULUS

General Considerations.—Evidence of stone in one portion of the urinary tract calls for a complete investigation before treatment is begun.

Stone in the ureter or bladder suggests at once the possibility of the kidney as the original source and the further possibility of more stones in the kidney. Stone in the kidney is bilateral in a large percentage of cases—in 27 per cent. (Israel); in 50 per cent. (Legueu).

Stone in the kidney or ureter may have all the symptoms referred to the bladder or urethra. Stone in the ureter frequently causes only kidney symptoms.

With these facts in mind, we are not justified in operating for stone without learning all we can by means of urine examination, cystoscopy, renal and ureteral catheterization with the waxed bougie, mensuration of the pelvic capacity, *x*-ray examination with and without the 10 per cent. collargol injection (Braasch), bacteria cultures, and estimation of the total functional value of the two kidneys and of each kidney separately.

In the occasional case we are forced to operate promptly without full preliminary investigation, because of uremic or other threatening symptoms. In the case of acute blocking of the ureter by a stone threatening the vitality of the kidney, an x-ray to locate the stone or stones is followed by prompt operation.

While the indications in favor of operation are usually fairly clear whenever stone is present in the urinary system, yet there are many circumstances calling for the keenest judgment. In patients of advanced age we have the lack of recuperative power, post-operative pneumonia, and other dangers to consider, and should remember that a "successful operation," followed in a few days by death, generally brings discredit upon surgery, and often prevents other sufferers who present good surgical risks from seeking much-needed relief.

When both sides are affected with stone, either in the kidney or ureter, and both show some functional capacity, it is generally best to operate on the best side first, and give this kidney time for recovery, because the condition found on the poorer side may demand complete removal. It is a fairly well-established observation that the removal of a badly suppurating stone or tuberculous kidney results in a better total function, although this bad kidney may have possessed some functional capacity. If a badly diseased stone kidney has called for prompt removal and the other kidney is found to contain a stone not causing symptoms, we have a delicate problem for solution. The patient's age will be a weighty factor in our decision. Fortunately, we can study the functional capacity of such a kidney without disturbing it with the renal catheter. If, after months of observation, the capacity is found to be deteriorating, we advise operation. If blood, pus, or casts show that the stone is injuring the kidney, we operate. If the Röntgen ray shows a large stone, we are confronted with the probability of a serious operation, and, on the other hand, with the certainty of kidney destruction if operation is withheld. If the Röntgen ray with collargol injection of the pelvis shows a small stone, probably located in the pelvis, we have the prospect of a pyelolithotomy, which should do the kidney very little or no injury.

Stone in the Kidney.—The ideal treatment for stone in the kidney is incision, either through the pelvis or cortex, removal of the stone, closure of the kidney incision, and closure of the lumbar wound with one or two gauze-rubber finger drains down to the kidney, to be left twenty-four hours. With a thin patient and small, non-adherent kidney, it is generally easy to slip the kidney out of the wound, and thus simplify the operation. The ureter should be freed first and lightly tied, to prevent stones from slipping down. Leave the ligature long and secured by a clamp outside of the wound, as a reminder at the end of the operation. Free unbranched stones, single or multiple, in the kidney pelvis are usually easily removed through an incision in the posterior wall of the pelvis. The pelvis is closed by fine catgut suture and reinforced by drawing some of the perirenal fat over the suture line with interrupted catgut suture. Pelvis and ureter wounds heal quickly without suture if there be no obstruction lower in the urinary tract. Temporary drainage should be left, whether suture is used or not.

For dendritic stone free incision through the cortex offers more certain exposure of all calices, and better opportunity of finding possible loose particles of stone. This incision should follow the line of meeting of the posterior and anterior arterial trees, which is usually one centimeter or less posterior to the midline of the kidney convexity. The first opening to the pelvis should be made with blunt forceps, and the remainder of the incision made from the pelvis outward with a blunt-edged curved knife, a curved liver needle, or a silver wire.

Small stones in the extreme calices or in the kidney substance are sometimes difficult to locate by palpation or by needling, and if the difficulties call for careful palpation, such impedimenta as rubber gloves should be removed.

If the preliminary investigation has shown that the affected kidney is doing but little work and the other kidney is normal, and particularly if the stone kidney be infected or badly degenerated, conservative surgery calls for its removal. The question of primary removal will likewise depend upon the patient's age and general condition. The writer has had two patients with stone and fibrosis confined to the lower half of the kidney, the upper half appearing normal. A V-shaped resection of the affected portion and smooth closure of the pelvis and cortex by interrupted catgut sutures resulted in prompt recovery and continued health.

Stone in the ureter is located within six centimeters of the bladder in over 50 per cent. of the cases.* In 20 per cent. of cases the stone is within six centimeters of the kidney, and in 14 per cent. at or near the pelvic brim.

Stone in the ureter is not infrequently passed spontaneously after renal catheterization. This is made more probable by the injection of oil. Now that we have improved catheters for gradual dilatation of the ureter, we will undoubtedly induce more stones to pass after dilatation and oil injection.

Stone impacted in the lower end of the ureter and presenting in the bladder can often be dislodged and removed through the cystoscope. If too large or too impacted for removal through the cystoscope, stone in the bladder portion of the ureter in men should be removed through a suprapubic cystostomy opening. From within the bladder the ureteral orifice can be stretched or incised sufficiently to allow delivery of the stone.

In women stones low in the ureter can be removed through the vagina. The writer first passes a small renal catheter, to act as a guide for the ureteral incision. After the vaginal vault is incised and the ureter located, a blunt hook or blunt needle carrying a traction suture is passed around the ureter with its contained catheter, and the ureter is easily drawn into the vaginal incision for the further work of lithotomy.

Stone low in the ureter in men, and stone in women just too high for vaginal removal, may best be reached through a low McBurney or rectus muscle incision, keeping outside the peritoneum. Stone at or near the pelvic brim is easily reached by a McBurney incision, made directly over the stone, and avoiding a peritoneal opening. Ureter stone between the pelvic brim and the kidney, unless immediately below the pelvis, is reached more easily by the flank incision, with the patient in a dorsal or slightly lateral position, than through a lumbar incision with the prone position, as for stone in the kidney. A small renal catheter passed to the kidney and left during the operation is a great aid in locating the ureter in any stone operation. Should a catheter not pass, the ureter may be darkly stained and more easily located by giving the patient methylene-blue twenty-four hours before operation.

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* Schenk, Johns Hopkins Hospital Reports, vol. x.

Some surgeons advocate the transperitoneal operation for ureteral stone. This adds to the dangers of peritonitis, particularly if the urine be infected. If one wishes to remove a diseased appendix or do other intraperitoneal work through the original abdominal wall incision, this can be done by incising the peritoneum after the work for the ureteral stone has been finished extraperitoneally.

After the removal of ureteral stone, dilators should be passed into the ureter above and below the site of the stone, to overcome the stricture tendency so often present about a stone.

The incision in the ureter wall may be closed by superficial interrupted sutures of fine catgut loosely tied, or the incision may be allowed to close without suture, which it usually does very quickly. In either case temporary drainage to the ureter is indicated.

Stone in the bladder may be removed by one of several methods. If the stone is small, it may be passed spontaneously after dilatation of the urethra and injection of oil. It may be grasped by the alligator forceps and removed through the cystoscope, or if slightly too large for extraction through the instrument, it may be grasped, drawn up against the cystoscope, and dragged through the urethra as the instrument is withdrawn from the bladder. A bladder stone too large for the foregoing may first be crushed and the particles then washed or drawn from the bladder with the Bigelow aspirator.

Considerable controversy exists over the relative merits of removing stone from the bladder by crushing and aspiration or by a cutting operation. The average case of calculus can undoubtedly be restored to health more rapidly by the crushing operation in the hands of an expert. In the hands of a surgeon without special ability as a cystoscopist, the patient is safer with a cutting operation.

Certain cases demand the cutting operation. Vesical calculus is not an uncommon urinary tract disease in children. The relatively high position of the bladder in children makes the extraperitoneal cystostomy an easy operation. The bladder should first be distended with air or fluid. In many cases of calculus the bladder is infected, ulcerated, and contracted, and this condition can be treated much more effectively by a cystostomy opening and frequent or constant irrigation of the bladder until the mucosa is healed. In women with capacious vaginas the removal of a stone and the subsequent irrigations through the vesicovaginal opening are comparatively simple procedures.

A stone so large that cystoscopy or the use of the lithotrite is difficult calls for a cutting operation. A stone may be partially pocketed, so the lithotrite can reach but the superficial portion of the stone. Multiple stones in an infected loculate bladder demand a thorough examination, such as can be made only through a cystostomy opening, and the bladder is best treated by the open method until the mucosa is healed.

TUMORS OF THE URINARY TRACT

Tumors of the Kidney.—It must not be forgotten that renal tumors may proceed to a stage beyond surgical relief without other symptoms than hemorrhage. Indeed, this sign may also be wanting until the tumor is beyond removal. A comparatively small tumor may so increase the weight of the kidney as to cause a prolapse and a feeling of weight or stiffness in the loin.

Usually, tumor is accompanied by blood in the urine, pain, and palpable tumor, and the malignant varieties may be accompanied by fever and cachexia, especially if infected.

All these signs and symptoms may be present in renal calculus, tuberculosis, pyonephrosis, and other forms of renal suppuration, so it is evident that the surgeon must often arrive at his diagnosis of renal tumor by a process of exclusion.

An *x*-ray picture of a collargol injection of the pelvis, leaving the ureteral catheter in position, is of considerable diagnostic value in showing the relationship between the upper ureter, pelvis, and tumor mass. This, however, does not exclude a non-renal tumor which happens to lie in line with the kidney pelvis. A renal tumor sometimes extends into the pelvis and for some distance down the ureter, and in such a case the collargol picture of the greatly dilated pelvis and ureter might be mistaken for hydronephrosis or pyonephrosis due to obstructed ureter. Mensuration of the pelvis in such a case would help in the correct interpretation of the *x*-ray picture.

A positive diagnosis is possible only by exploratory incision, and one must bear in mind that even by this means a small renal tumor causing hematuria may be overlooked.

A rapidly growing fixed renal tumor in childhood is most likely to be sarcoma, although hypernephroma and congenital polycystic kidney must be considered in the diagnosis.

Hematuria and rapidly developing cachexia are most likely to occur with sarcoma. Metastases are more frequent with sarcoma, although often present with hypernephroma. Bilateral involvement suggests congenital cystic kidney. Operation is contraindicated if metastases are found. If the child is in poor general condition, operation is contraindicated, because children are poor surgical risks under the best of conditions.

In the adult hypernephroma is by far the most frequent kidney tumor, although sarcoma occurs with sufficient frequency to be considered, particularly if the tumor be of rapid development and accompanied with hemorrhage, metastases, and cachexia.

Carcinoma and malignant adenoma are much more rare, and usually of slower development and smaller size than the hypernephroma or sarcoma.

Hypernephroma may exist for years as a small tumor with few or no symptoms, and then suddenly take on malignant activities. The same may be said of adenoma. Carcinoma of the kidney rarely forms a large tumor, and usually spreads by direct infiltration, although glandular metastases may occur. Tumor of the kidney developing after operation for carcinoma elsewhere is likely to be carcinoma.

While the removal of malignant disease of the kidney does not form an encouraging chapter in surgery, future results should show great improvement because of early diagnosis. The surgeon is often prompted to take great risks in cases of little promise because of the pain or hemorrhage. Great risks are justifiable because one cannot be certain of the character of the tumor without operation, and surprising results in the restoration of health and prolongation of life are sometimes obtained even in cases that show extension of the growth to other tissues at the time of operation.

Questions of surgical technic need not be discussed at length in this section. The author prefers the lumbar extraperitoneal operation wherever possible. The patient should be well flexed in the lateral position, so that, if necessary, the incision can be carried well forward and a combined extraperitoneal and intraperitoneal attack made.

In suspected congenital cystic kidney, even if the opposite kidney shows good function, the abdominal route is chosen, in order thoroughly to explore the other kidney. Should the better kidney show a cystic condition, the abdominal wound is closed and a small lumbar wound made for nephrotomy and drainage on the side presenting symptoms.

In case a hypernephroma shows extensions of growth into the ureter or into the veins, these extensions should be removed with the tumor. The arteries are secured and cut, the ureter tied and cut below the growth, and the vein has a purse-string ligature carefully passed in its outer walls; and, as the vein is cut with a knife at a point between the kidney and the purse-string, the kidney is removed, at the same time drawing the extended growth out of the vein and closing with the purse-string ligature.

Perirenal Tumors.—These are rare, but should always be borne in mind in making a diagnosis of a tumor in the loin, with which signs and symptoms of urinary tract disease are absent.

Lipoma is the most common perirenal tumor, and it may present as a solid or cystic feeling mass in the loin, or it may grow to encroach on nearly every portion of the abdomen.

Fibroma, myxoma, cysts of the adrenal, and cysts of the renal walls developing outward are all found in this region. Sarcoma, carcinoma, and hypernephroma of the perirenal space are usually primary in the kidney, adrenal gland, or liver.

In removing any perirenal tumor, one should be chiefly concerned against injury of the blood-vessels of surrounding organs, particularly of the colon.

Tumors of the Bladder.—In dealing with a growth in the bladder the method of attack varies with the conditions in the individual case. If the growth be a simple polypus, myoma, fibroma, or fibropapilloma, and not too large to deliver through the urethra, it may be removed by means of the snare and cautery. In the female large growths may be removed through a vesicovaginal opening if the vagina has been dilated by child-bearing. In case of doubt as to the route of attack in these benign growths, it is best to use the suprapubic route, and, by first distending the bladder with an antiseptic solution to displace the peritoneum upward, operation can usually be done extraperitoneally.

Villous papillomata, if attached by a pedicle, and the sessile variety, if small, may be removed through the cystoscope, by use of the cautery, or by the scissors or snare. In every case the base should be well cauterized and the tissues carefully examined for evidence of malignancy. Large sessile growths should be removed by the suprapubic route, taking in the subjacent bladder-wall at least down to the serosa. After removal of the tumor the base should be carefully cauterized, and if suture is necessary, fine twenty-day catgut tied inside the bladder is sufficient, unless the peritoneum has been opened, in which case the serosa should be reinforced with fine silk or linen. Enough experience is now at hand in the work of Keyes and others to warrant the belief that the fulguration method, with the use of the high-frequency current, will take the place of other operative measures in treating all papillomatous tumors of the bladder.

It seems almost trite to say that no operation should be done for papillomatous tumor of the bladder, or for any tumor that might be malignant, without first making a careful cystoscopic study and charting every tumor, particularly with reference to the ureter orifices.

After removal of papillomatous growths the patient should be kept under observation for possible recurrences. Careful microscopic examination should be made.

In the case of infiltrating carcinoma of the base of the bladder operation should not be undertaken until the condition of the prostate or of the uterus is investigated. In these cases of infiltrating carcinoma the cystoscope may show relatively small involvement of the bladder-wall, and promise a comparatively easy operation, while careful bimanual palpation shows extensive perivesical growth and enlarged iliac glands, and indicates that operation will be useless.

Unfortunately, carcinoma of the bladder usually occurs late in life, in subjects presenting poor operative risks. Such patients are prone to pay but little attention to the bloody urine, frequency of voiding, and pain, until the latter becomes unbearable, and by the time a surgeon is consulted, the growth has advanced too far for operative relief.

In cases showing only one wall of the bladder affected and presenting fair operative risk from other viewpoints, an operation should be undertaken. This should be done only by a specialist of wide experience in bladder work, for anything short of a thorough surrounding of the growth is worse than useless. This operation should always be done by the transperitoneal route, and should include the entire thickness of the bladder-walls, giving the tumor a wide margin.

The novice in bladder work will fear that he is not leaving enough normal bladder, whereas it is surprising how efficient an organ will develop when scarcely enough bladder is left for an approximation of the cut edges. In these extensive mutilations, whether for cancer, benign tumors, tuberculosis, or chronic infiltration, efficient suprapubic drainage should always be left.

In examining a patient for possible tumor of the bladder the cystoscopist should not be misled by various conditions which may simulate tumor. A large stone impacted in the lower end of the ureter, but entirely within the ureter, may cause a tumor-like projection into the bladder. A cystic dilatation of the bladder portion of the ureter forms a tumor, easily diagnosed, in some cases, by its intermittent swelling and collapse, and in others the condition is suspected because of the soft, elastic character of the projecting cystic wall.

HEMORRHAGIC DISEASES OF THE URINARY TRACT

Blood in the urine is a symptom too often neglected or made light of by the patient and by the general practitioner. The medical aspects of hematuria are discussed by Dr. LeFevre. Most of the important surgical diseases of the urinary system have an associated hematuria during some stage of their activity. We will discuss here only those conditions which are difficult of diagnosis, and which are of serious import because of the continued loss of blood or because of the disastrous results of procrastination in diagnosis and treatment.

In any case of symptomless hematuria when the blood appears and disappears suddenly, and usually with reference to exercise, and in which cystoscopy shows a normal bladder and urethra, one should think first of malignant tumor of the kidney or of papilloma of the kidney pelvis or ureter.

In either of these comparatively rare conditions the urine is normal except for the blood, free hemoglobin, and associated albumin.

The cystoscopic picture is negative, or there may be seen about one ureteral orifice a slight reddening of the mucosa or a distinct swelling or pouting of the mons ureteris, and a varying degree of increase in the vascularization. If the examination is made during a period of bleeding, the bloody urine can be seen coming from the diseased side.

In a case of symptomless hematuria in which the bleeding is more or less continuous and occurs regardless of exercise, one thinks first of chronic nephritis with local arteriosclerotic infarcts and of renal varix. The urine in either of these conditions may show no change other than the blood content.

In any of the above symptomless non-suppurative hematurias an early diagnosis is not possible without exposure of the kidney.

With exposure and even with splitting of the kidney a small tumor of the kidney may be overlooked. Papilloma of the kidney pelvis is found on splitting the kidney, and it should have thorough excision and cauterization of the base, because of the tendency to recurrence and to the development of malignancy. Any infiltration about the base of a papilloma of the pelvis calls for an immediate pathologic report, and if malignancy is found, for immediate nephrectomy.

If careful preliminary investigation has led one to believe that the monolateral symptomless hematuria is due to nephritis, and the exposure of the kidney reveals areas of sclerosis over the surface, one is justified in merely decapsulating and doing a kidney fixation. This relieves the intracapsular tension and the bleeding ceases. However, in these cases of "renal epistaxis" (Gull) the surgeon feels that his diagnosis is more accurate and certain if the kidney is laid wide open for inspection, and experience has taught that most of these cases are permanently cured of the bleeding by this method. Renal varix, angioma, nevus, or varicosity of the renal papilla is discovered only after laying the kidney open and making careful examination of all the papillæ. Excision of the vascular area gives one the satisfaction of a microscopic examination, but is not necessary after nephrotomy. The division of the chief arcuate veins results in cure of the varicose condition.

THE NERVOUS SYSTEM

DISEASES OF THE NERVOUS SYSTEM

By William G. Spiller, M.D.

Diseases of the Cerebral Meninges

MENINGEAL HEMORRHAGE

The common cause of hemorrhage within or upon the meninges is trauma of the head, with or without fracture. The hemorrhage may be upon the dura, as when the middle meningeal artery is ruptured, or it may be beneath the dura and within the pia. The author has known extensive subdural hemorrhage to result from a blow upon the head without any fracture of the skull. Occasionally, rupture of one of the superficial cerebral arteries occurs independently of trauma, as when the vessels are diseased and yield to increased blood-pressure. Such hemorrhage upon the brain is more uncommon than hemorrhage within the brain. The bleeding may come from one of the cerebral sinuses, and may then be either upon or beneath the dura, or both upon and beneath it. It may be caused by sinus thrombosis. Sometimes it occurs on a portion of the brain remote from where the injury of the skull has been. This condition is known as contre-coup, and the symptoms in such a case may indicate that the cerebral injury is at a distance from the seat of external trauma. The symptoms may be transitory, and then are caused by disturbances that are not persistent. After a few days or a week the pseudo-localizing signs may disappear, while those indicating persisting intracranial pressure may induce the surgeon to operate at the seat of trauma, and may lead to the discovery of a large extradural or subdural hemorrhage. The pressure produced by a large clot may be very serious and even may cause a fatal and rapid termination.

The hemorrhage may come from a ruptured aneurism. Aneurism of a cerebral artery is extremely difficult to diagnose clinically, and the symptoms are chiefly those of pressure. The rupture of an aneurism may occur from excessive cardiac action, mental exertion, or from unrecognizable cause. Probably it results in the greater number of cases from gradual thinning of the aneurismal sac.

The cerebral hemorrhage of the newborn is the cause of paralysis and epilepsy in many cases, and the prompt recognition of the existence of, and the removal of, the clot soon after birth may be of great importance. The bones of the skull in the child at birth are soft and overlap during the delivery of the head, and this overlapping, with possibly the pressure from the forceps, may cause rupture of intracranial vessels, most likely of the superior longitudinal sinus or cortical veins, with great pressure upon the delicate and soft brain, as yet very imperfectly medullated. The hemorrhage usually is chiefly upon the brain, but doubtless there is also bleeding within the brain in many cases, as blood-clot has been found after difficult labor in the cerebrum, medulla oblongata, or spinal cord. The hemorrhage may be upon the tentorium, about the cerebellum, or over both cerebral hemispheres. Removal of meningeal hemorrhage occurring at birth has been advise by Cushing, and he has been successful with this treatment in some cases of this character.

Symptoms.—When hemorrhage occurs, unconsciousness develops rapidly, provided the bleeding is intense enough to cause much pressure; the respiration becomes more frequent, and the cardiac action slowed, and there may be vomiting. Later, rapid pulse may take the place of slow pulse, as the pneumogastric nerve becomes paralyzed. Death may occur soon or may be delayed some days, or there may be partial or complete recovery. As the hemorrhage often is on the upper part of the brain and on one side, hemiparesis or hemiplegia is frequent. The symptoms may require several days for their development, depending on a gradual leakage of blood and increasing intracranial pressure. Jacksonian epilepsy occurs in some cases from irritation of the motor area of one side, or the convulsions may be general. The symptoms of meningeal bleeding resemble closely those of concussion of the brain, by which should be understood degenerative changes in nerve-cells and nerve-fibers, minute intracerebral hemorrhages, and minute areas of softening, edema of the meninges and possibly of the brain, etc. The gradual development of symptoms during a period of several hours or even days is common in hemorrhage, but is rare in cerebral concussion, although late hemorrhage from extension of an area of softening, and thereby involvement of other vessels, or from progressive degenerative changes in the vessels, may occur in cerebral concussion.

One must not be led astray in his diagnosis of location of the clot by the existence of ocular palsies. These may occur when the lesion is remote from the nerves supplying the ocular muscles or their centers, as in cases under the author's observation when the hemorrhage was over the occipital lobe, or equally remote. The sixth nerve is especially liable to injury on account of its long intracranial course. Recent investigation of Cushing* indicates that this nerve may be compressed by an adjacent artery when the intracranial pressure is increased.

As meningeal hemorrhage not infrequently occurs in intoxicated persons, it is sometimes difficult to distinguish it from a drunken sleep. Delay of a few days will usually permit a correct diagnosis to be made. Meningeal hemorrhage may cause albuminuria, but does not cause casts, and this should be remembered where uremia is suspected. The situation in which a person is found, as by the side of a railroad track, is of value in diagnosis, as indicating injury rather than uremia or intoxication, though, of course, it is not conclusive.

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* Brain, vol. xxxiii, 1910.

Treatment.—If a meningeal hemorrhage exist, the treatment is surgical, but some facts must be borne in mind regarding the time at which operation should be performed. As already pointed out, the signs of cerebral concussion may simulate closely those of meningeal or cerebral hemorrhage, and operation in the former condition will be more likely to do harm than good. Unless the evidences of intracranial hemorrhage are very clear, as when a depressed fracture or a large subcutaneous clot of the head is found, associated with signs of intense cerebral disturbance, it is better to wait a few days or a week, after which operation should be done if grave symptoms persist and there is reason to fear hemorrhage. Too early opening of the skull may cause the operation to be made at a part some distance from the real lesion, as when contre-coup exists; whereas if the surgeon had been a little patient the symptoms "at distance" would have disappeared within a few days, and he would have been able then to determine the proper site for opening the skull. It is to be remembered that in some cases, possibly those in which little hemorrhage has occurred, recovery may result without surgical intervention even where semiconsciousness had lasted a few weeks. Where hemorrhage exists, the clot should be removed, as there is danger of a late development of epilepsy if it be allowed to remain and become a source of irritation, and the convulsions may first appear many years after the cerebral injury. Where grave doubt is entertained as to the presence of meningeal hemorrhage, the wiser course is to expose the brain and seek for the clot, after waiting a few days or a week, provided the patient's condition permits this delay. With the use of antiseptic surgery, osteoplastic flaps, and proper technic the danger of operation in a doubtful case is less than a too prolonged expectant treatment. The physician and the surgeon must try for that happy combination of conservatism with surgical bravery.

During the early period of meningeal hemorrhage stimulation of the heart and respiration will often be necessary.

Where the hemorrhage occurs at the base of the brain we cannot expect to accomplish much by operation, unless decompression be done to relieve intracranial pressure, but where the vagus nerve is implicated, swallowing may become impossible, and rectal feeding then may have to be employed. In one of the author's cases in which this occurred, the stomach-tube could not be employed, because the paralysis produced relaxation of one side of the esophagus with the formation of a pouch at the cardiac end of the stomach, and in this the tube almost invariably lodged when an attempt was made to pass it. The discomfort caused the patient thereby was so great that he would not permit the treatment to be continued. In a case such as this, when rectal alimentation becomes impossible, as it is likely to do after a time, an opening in the wall of the stomach may be necessary, so that food may be administered through the opening.

This operation is likely to be deferred until the patient has become weakened by the want of food. In the International Clinics, vol. iv, 1903, p. 102, the author has reported a number of cases bearing on the subject of meningeal hemorrhage and its treatment.

EXTERNAL PACHYMENINGITIS

Inflammation of the external portion of the cerebral dura does not exist as an independent condition, and is associated with diseases of the skull or is part of a general pachymeningitis, internal as well as external, and of leptomeningitis. It may follow trauma of the skull, with or without infection. The localized purulent form is seen frequently as a result of suppurative middle-ear disease, and less frequently following purulent processes in the nasal passages, and appears as an extradural abscess. External pachymeningitis also may be caused by some irritation from within, as from a tumor or abscess. In the fibrous form adhesions often occur between the dura and the skull. It may be caused by syphilis, tumor, caries of bone, erysipelas, etc. Sinus thrombosis may develop secondarily to external pachymeningitis, and is probably most common in the lateral sinus and following otitis media, although other sinuses are occasionally affected. The treatment is almost entirely surgical. Where syphilis is at fault, iodids and mercury should be employed, but operation usually must be depended upon for relief if the symptoms justify surgical intervention. Where pus occurs within the skull, it should, of course, be removed, but often there is great difficulty in determining whether the process be purulent or not. The prognosis of operations upon abscess is more favorable in the extradural form than in the intradural.

INTERNAL HEMORRHAGIC PACHYMENINGITIS

A new membrane, sometimes in several layers, inclosing a collection of blood, occasionally is found in cases of paretic dementia and other forms of chronic insanity, chronic alcoholism, senile atrophy of the brain, trauma, severe anemia, infectious diseases, tuberculosis, congenital or acquired syphilis, nephritis, cardiac defects, etc. Much less important is the fibrous thickening on the inner surface of the dura without hemorrhage. This in some instances probably is the first stage of the hemorrhagic form. Occasionally the process is purulent. Most pathologists favor the view that the membrane forms first and the rupture of the delicate vessels contained within it causes the hemorrhage; this hemorrhage in turn produces irritation and the formation of more membrane. In this way a hematoma may be developed so large as to cover and compress one entire cerebral hemisphere, or it may extend over both cerebral hemispheres and well down toward the base of the brain, as in a case observed by the author in which it was found in a child nine years of age. It is usually a lesion of advanced life, but does occur occasionally in young children, as already mentioned, and yet seldom so late as the ninth year.

The symptoms during a considerable period of time are usually those of intracranial pressure and congestion, and may be slight or severe, depending on the intensity of the process. The patient may have headache, vertigo, failure of memory, and some stupor; he may also be hemiparetic or hemiplegic. Unilateral convulsions may occur, and headache is common and is not sharply localized. The diagnosis may be impossible, especially as the internal hemorrhagic pachymeningitis often is associated with some disease, such as paretic dementia, and the symptoms of the latter may predominate. As repeated hemorrhages are likely to occur from the delicate vessels, exacerbations of the symptoms are not uncommon, and the clinical picture of cerebral apoplexy may be produced. Recovery from the first apoplectic attack is possible, but if the hemorrhage has been extensive, the termination may be a fatal one. If life be prolonged, improvement with relapses may be expected, and possibly complete recovery, at least temporarily, but from the nature of the process the patient is exposed to repeated attacks.

Where the new membrane extends to the base of the skull, implication of some of the cranial nerves may result, but paralysis of these nerves is uncommon. Optic neuritis, however, may be present. Headache may be associated with tenderness of the scalp on percussion. The symptoms are those that are found in other cases of new-growth within the cranial cavity, meningitis, sinus thrombosis, cerebral hemorrhage, abscess, etc. It is questionable whether a positive clinical diagnosis of internal hemorrhagic pachymeningitis can be made, although the condition may be suspected. The attack may be confused with a uremic coma. The localizing symptoms, the persisting headache, the gradual increase in the intensity of the clinical manifestations, the exacerbations, the unilateral convulsions, occurring in a person who has been intensely alcoholic or who has paretic dementia or some other form of insanity, may make the diagnosis a probable one.

The treatment of internal hemorrhagic pachymeningitis is most unsatisfactory. Leeching or wet-cups behind the ears or over the temples, bleeding, an ice-bag to the head, or lumbar puncture may afford more satisfaction to the relatives than relief to the patient, although these means are recommended as worthy of trial. It is impossible to remove the hematoma in any of these ways, and therefore there is small chance of benefit. The general condition should be improved, but after a hematoma has once formed removal by surgical means alone could be of benefit, and yet this mode of treatment has seldom been employed. Where there are symptoms suggestive of a mild form of internal hemorrhagic pachymeningitis, all causes of cerebral congestion should be avoided as far as possible. Mental work should be light, and, as a rule, the disease with which the patient is afflicted prevents any serious mental application. Alcoholism must be combated so far as possible. Attention should be paid to the treatment of syphilis or nephritis, if either of these diseases exist. When the stupor becomes coma and the paresis becomes paralysis, the intracranial pressure is intense and stimulation may be needed, but it is questionable whether it will accomplish much in most cases. Headache may be treated by the remedies usually employed for this purpose, such as the coal-tar preparations, and more rarely morphin.

If removal of the blood-clot were all that is necessary, operation in cases of internal hemorrhagic pachymeningitis would be advisable, but it cannot cure the fundamental disease, the paretic dementia, the alcoholism, etc.; it cannot remove the tendency to the formation of new blood-vessels and repeated hemorrhage; then also the diagnosis is usually very uncertain. If the symptoms of intracranial pressure were very intense, opening the skull and removal of the collection of blood might be recommended, thereby diminishing the pressure upon the brain, though there is danger that the hematoma might form again. Operation is said to have been first recommended by Ceci (cited by v. Bergmann, p. 449), but v. Bergmann* is in doubt whether the case reported by Ceci was really one of internal hemorrhagic pachymeningitis. In a case reported by Annandale transitory improvement occurred after operation (cited by F. Schultze†). In Jaboulai's case, in which a hematoma was said to have been opened, recovery occurred (cited by Henschen‡), as seems to have occurred also in Michaux's case (cited by v. Bergmann, p. 451).

A distinction must be made as regards the cases occurring after trauma, as in these hemorrhage probably results from the rupture of one vessel, and a tendency does not exist to repeated bleeding from many imperfectly formed vessels. Removal of the hematoma caused by trauma is much more likely to be followed by permanent recovery, but the condition is somewhat different.

Surgical treatment is worthy of further trial in cases of internal hemorrhagic pachymeningitis. The chief difficulty lies in the diagnosis and in the fact that in some cases both sides of the brain are implicated.

ACUTE LEPTOMENINGITIS

The term signifies an inflammation of the leptomeninges of the brain and spinal cord, but we are concerned in this chapter with the disease only in so far as it affects the membranes of the brain. Experience has shown that usually the coverings of the spinal cord are also the seat of inflammation when those of the brain are implicated. The micro-organisms invading the brain and setting up inflammation may be of several varieties.§ The streptococci seem to cause the most severe inflammation, according to F. Schultze, while the staphylococci and pneumococci are less formidable. The variety of bacteria found in the cerebrospinal fluid obtained by lumbar puncture gives some indication of the severity of the process.

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* Von Bergmann: Die chirurgische Behandlung von Hirnkrankheiten. Third edition, 1899, p. 449.

† F. Schultze: Die Krankheiten der Hirnhaute und die Hydrocephalie. Nothnagel's System, Band IX, 3. Theil, 1. Abtheilung.

‡ Henschen: Handbuch der Therapie innerer Krankheiten. Penzoldt und Stintzing. Third edition, vol. vi, 1903.

§ F. Schultze: Die Krankheiten der Hirnhaute und die Hydrocephalie. Nothnagel's System, Band ix, 3. Theil, 1. Abtheilung, p. 167.

The inflammation is manifested by intense cellular infiltration of the pia-arachnoid, the cells being chiefly mononuclear in the tuberculous or syphilitic forms, and polynuclear in the purulent forms; in the latter is included the epidemic variety. This cellular infiltration usually extends a short distance into the substance of the brain, but may be part of a severe encephalitis. The pia and the blood-vessels are thickened if the process has been of a sufficiently long duration, and small hemorrhages may be found within the meninges. A severe meningitis may escape detection by the naked eye, although a microscopic examination may show an intense cellular infiltration about many of the cranial nerves and within the pia. Edema of the pia often occurs with intense meningitis.

Symptomatology.—The symptoms are those of irritation and paralysis, depending on the intensity of the process. General symptoms are headache, vertigo, nausea, vomiting, convulsions, and choked disks. These are the same that are found in cases of intracranial tumor, though fever may occur in meningitis and seldom occurs in brain tumor. Rigidity of the neck, retraction of the head, ocular palsies that may exist only a short time, depending on the varying intensity of the process, photophobia, hypersensitiveness of the skin, difference in size of the pupils, contraction or dilatation of the pupils, Kernig's sign, Brudzinski's reflexes, stupor or coma, slowing of the pulse followed by increased rapidity, etc., are symptoms common in meningitis. Many of the cerebral nerves may show signs of irritation. As an illustration, intense fibrillary tremors and paralysis of one masseter muscle have been observed by the author from implication of the motor branch of the trigeminal nerve in meningitis.

The diagnosis of the different forms of meningitis from the symptoms is sometimes very difficult, and it may not be easy to determine whether the case be of the epidemic, tuberculous, or other variety. The presence of multinuclear cells in the cerebrospinal fluid obtained by lumbar puncture would indicate the presence of purulent meningitis, and the Weichselbaum-Jaeger meningococcus would point toward the epidemic form. Small mononuclear cells (lymphoid cells) are more suggestive of the tuberculous or syphilitic variety, and the presence of the tubercle bacillus in the cerebrospinal fluid would demonstrate the tuberculous nature of the process, although frequently it may be very difficult to detect this bacillus. It may be possible to have a mixed infection. Grawitz believes that the leukocytes in the blood are not increased in the epidemic form, and that there is a distinct leukocytosis, chiefly of polynuclear cells, in the tuberculous form, in contrast to the lymphocytosis of the cerebrospinal fluid.

Treatment.—In the epidemic form it is wiser to keep the patient isolated, although the contagiousness probably is not great, and in hospitals not infrequently no attempt at isolation is made, especially when children are the victims. Opinion regarding contagiousness has been modified on account of the contraction of the disease by those attending patients. Quiet is of great importance, as noise of any kind is very annoying to the patient. In all cases where there is paralysis of the limbs, a water or air mattress is desirable. All purulent processes about the head are liable to cause meningitis. The author has known it to develop after panophthalmitis and removal of the eyeball, also following frontal sinus disease. Treatment of local disease should be begun early, and special attention should be directed to an examination for otitis media, and to proper drainage in disease of the nasal sinuses. Erysipelas of the face may be a cause. A severe cold of the head is believed by some to be the starting-point of meningitis (Henschen), but probably sinus involvement is necessary when a meningitis results from cold.

Salicylate of sodium is sometimes employed in the treatment of meningitis. The fever must be combated by means of sponging; seldom can cold bathing be endured on account of the pain caused by handling. Diaphoretics are useful, as are also laxatives and enemas when constipation occurs. Headache and sleeplessness need attention. Veronal in ten-grain doses for adults, or trional, sulphonal, or any of the hypnotics may be employed, but the condition of the heart must be watched when these drugs are given. Vomiting may be combated by the administration of small pieces of ice, charged waters, champagne, hypodermic injections of morphin, small doses of cocain, or spirits of chloroform. Stimulation of the heart and respiration may be needed. Inunctions of mercurial ointment, or hypodermic injections of mercury, or iodids are useful in some cases, even where syphilis is not suspected, more especially in the subacute and chronic types.

Irrigation of the nose and pharynx with a normal saline or mild antiseptic solution may be practised once or twice daily, as the posterior nasopharynx is believed to be a portal of entry for the infection, and is sometimes the seat of catarrh. The nutrition of the patient must be maintained. The diet should be liquid or semi-liquid and easily digested. Where swallowing is impossible, the mouth or nasal tube or rectal feeding must be employed. It is well to avoid the latter as long as possible, because disturbances of the intestines are likely to occur after prolonged rectal feeding. Alcohol may be needed to combat depression. Calomel in laxative doses is of service. Bromids in doses of ten to thirty grains for an adult two or three times daily may be used to relieve pain and quiet the patient, but where pain is acute, the coal-tar preparations may be employed. Acetanilid in five-grain doses, phenacetin or antipyrin in similar amount or a little larger dose, may be employed two or three times daily, but it is wise to combine such drugs with a mild cardiac stimulant. Where relief is not obtained in this manner, morphin may be resorted to, but it is well to avoid the use of this drug if possible, and to give it when necessary in the smallest doses capable of producing relief. It is believed by some to have a tendency to increase cerebral congestion. By others opium is regarded as indispensable for pain, restlessness, and hyperesthesia, and it may be combined with gelsemium, cannabis indica, belladonna, or ergot. Grawitz recommends the abundant administration of fluids to increase diuresis, and saline enemas several times daily. The hyperemia of the brain and the exudate upon the brain and within the ventricles cause grave symptoms. Relief may be obtained by lumbar punctures, ice upon the head, wet-cupping or leeching of the head, unless the vitality of the patient be too low to permit any removal of blood. Lumbar puncture has given relief for longer or shorter time from headache, vomiting, fever, impaired vision, etc., chiefly by removal of intracranial pressure. In other cases opening the skull and removal of fluid in this way have been of much benefit, and the author has known it to cure purulent meningitis. Puncture of the cerebral ventricles is at present a doubtful expedient. Hexamethylenamin (urotropin), in five-grain doses for an adult, may modify the course of the meningitis.

When the patient is in the stage of recovery, and fever and pain have ceased, massage and electricity applied to the limbs will be of benefit, as in many other cases where weakness is a prominent symptom. The iodids have been found useful in the later stage of meningitis. Even the tuberculous meningitis is not hopeless, as a number of cases are now on record in which recovery has occurred. Much can be done to ward off tuberculous meningitis. Tuberculous foci in the body, hypertrophied tonsils, adenoid vegetations, etc., should receive attention. The child of a family in which tuberculosis has occurred should be guarded more than the offspring of healthy stock, and should live much in the open air.

Tuberculin is regarded by some as a valuable remedy in tuberculosis, but experience is required for its proper employment. Its value in tuberculous meningitis has not been fully established. Dr. Lawrence F. Flick* remarks that much has been written about the value of the different serums in the treatment of tuberculosis, and such variant opinions have been given that it is difficult to arrive at a just conclusion about them, the consensus of opinion, he adds, seems to be in favor of the usefulness of the serums. They should be used in the early stages of the disease. They have been so improved in quality that the objections which justly lay against their use in the beginning do not seem any longer to exist. Unfortunately, most cases of meningitis in childhood are of the tuberculous character. Lumbar puncture is of service in the diagnosis of tuberculous meningitis, but is of less therapeutic value than in other forms of meningitis.

Pilocarpin is recommended in the treatment of epidemic cerebrospinal meningitis by Vohryzek.† As this drug is employed to diminish intraocular tension, the idea occurred to him that it might be equally valuable for cerebral hyperemia. Investigations have seemed to show that it is capable of producing leukocytosis. The pilocarpin is recommended to be given by the mouth in doses of 0.05 to 0.07 centigram daily for adults, and 0.02 to 0.04 centigram for children under fourteen years of age. In the cases in which it has been employed it is said to have been of benefit, but the remedy has not come into general use for meningitis.

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* Hare: A System of Practical Therapeutics, second edition, vol. i, p. 785.

† Sémaine Méd., July 12, 1905, p. 330.

Charles G. Stockton, in speaking of the hot-bath treatment, as recommended by Aufrecht, temperature 104° F. to 106° F., continued for ten minutes, says the practice apparently is harmless, is generally followed by the relief of symptoms, and in some instances at least apparently has had a favorable effect upon the course of the disease. The method of employing hot baths as to duration and frequency varies considerably with different clinicians.*

Edward Waitzfelder has used diphtheria antitoxin in the treatment of epidemic cerebrospinal meningitis, following the example of Arthur J. Wolff. Waitzfelder thinks that a larger dose of antitoxin is necessary than in usually given in diphtheria, and that it should be repeated daily until urgent symptoms abate (not to the exclusion of lumbar puncture, which should be made for symptoms indicating cerebrospinal pressure). With the subsidence of delirium or coma, a lessening of the rigidity of the neck, of headache and photophobia, it is advisable that the amount of antitoxin be diminished, but its use should be continued at longer intervals until all central nervous symptoms have subsided. He is encouraged by the results of this treatment. Of seventeen cases so treated five recovered completely, three died (two were adults), and nine cases were under treatment at the time the report was made. Of the latter, five showed such marked improvement as to indicate probable recovery.† The diphtheria antitoxin, however, is seldom employed for meningitis.

Operation in cases of meningitis is of rather doubtful value. It has been proposed to expose the brain and wash off the meninges with 1:1000 bichlorid solution. The author has known the exposure of the brain to be very effective in one case of purulent meningitis (Shields, Spiller and Martin ‡). Where the symptoms are indicative of a localized collection of pus, *i. e.*, an abscess, operation is advisable. Much washing of the surface of the brain may dislodge many microorganisms and spread the infection. There is always danger of extension of the purulent process from the cerebral cortex to the base of the brain and the spinal cord, and washing of the brain may hasten this extension. As a rule, the patient will do better without operation where the symptoms are not localizing. Kümmell refers to the recoveries occurring after operation for purulent peritonitis, and speaks of recovery from purulent meningitis occurring after simple trephining. In tuberculous meningitis he has seen relief from pain, but not recovery, follow this simple operation.§

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* Stockton: Amer. Med., April 1, 1905, p. 519.

† Waitzfelder: Medical Record, March 11, 1905, p. 361.

‡ University of Penna. Med. Bul., Dec., 1909.

§ Kümmell: Sémaine Méd., May 3, 1905, p. 211.

Flexner's* serum has become of such importance in the treatment of the epidemic form of meningitis that it is advisable to give his description of its application.

He directs that the serum should be employed only by subdural injection, as much depends upon its concentration at the seat of disease. This concentration is not obtained where it is most desired when the serum is injected into the blood. There is little danger of producing a dangerous increase of intradural pressure from injection into the subdural space, as cerebrospinal fluid is withdrawn before the injection is made. In rare instances, in very young children, and in cases in which there is an obstacle to the inflow of the antiserum, great caution must be exercised. Should unfavorable symptoms arise, it is advisable to remove by lumbar puncture, or through suction by means of a syringe, part or all of the antiserum injected.

The earlier in the course of the disease the injections of the antiserum are made, the better are the results. A safe rule is to inject the antiserum at once, if a suspicion of meningococcal meningitis exists, without waiting to complete the bacteriologic diagnosis by film preparation or culture. The occurrence of a turbid or purulent fluid at lumbar puncture is always suspicious, and should call for immediate injection of the antiserum. When meningitis is prevalent, cases of doubtful nature are observed in which lumbar puncture shows sometimes clear and sometimes turbid fluid containing the meningococci and possibly very few leukocytes. Immediate serum injections in these early cases often cut short the disease. Lumbar puncture is important for the diagnosis of meningitis, and dependence must not be placed alone on the gross appearance of the fluid.

The antiserum should be kept in the refrigerator until it is to be used, and it should be warmed to the body temperature before it is injected. The minimal dose for a single injection may be regarded as 15 to 45 c.c., except in young infants, in which smaller doses may be used with equal effects. The serum usually passes readily into the spinal membranes, but it is desirable to remove as much cerebrospinal fluid as possible before injecting the serum. Raising the foot of the bed after the injection is completed hastens the spreading of the fluid.

The injections usually must be repeated several times, and a daily injection for three or four days is advisable, but it is imperative to control the injections by observations on the changes in the appearance and nature of the cerebrospinal fluid, and particularly upon it becoming clearer day by day and the meningococci growing fewer or disappearing. As long as meningococci are found, the injections should be repeated daily, and the organisms should be searched for in film preparations. Urticaria is frequently produced by the injections. In the fulminant and in certain very severe cases of the disease it is advisable to make two injections of maximal doses of the antiserum within the first twenty-four hours, and possibly even in the next twenty-four-hour period. Some cases that are very resistant respond ultimately to the injections, and the treatment may be of service even in chronic cases. It may be advisable, in some of the latter class of cases, to inject directly into the ventricles through the fontanel or by trephining. Injections should be resumed when relapses occur.

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*International Clinics, vol. iv, nineteenth series.

CHRONIC LEPTOMENINGITIS

The chronic form of inflammation of the dura may be the result of trauma to the head, when the dura may become thickened and adherent to the skull at the seat of injury. Chronic leptomeningitis is at times the result of syphilis or tuberculosis, or an acute meningitis may terminate in a chronic form. The tuberculous variety sometimes appears as isolated patches of thickening (méningite en plaque) showing under the microscope the tuberculous structure. These patches, being localized to one part of the cortex, cause symptoms closely resembling those of tumor. The author has described a case in which the disturbance of sensation, loss of sense of position and of stereognostic perception, with other symptoms, led to a diagnosis of a localized lesion of the parietal lobe and to operation.* Thickening and inflammation of the pia-arachnoid is a common condition in paretic dementia and some other mental diseases, or in atrophy or softening of the brain, chronic alcoholism, saturnism, senility, etc.

Chronic leptomeningitis may exist without causing symptoms, or without being a part of a general process, such as paretic dementia, and the symptoms may be obscured by those of a general disease. Headache and vertigo are probably indications of the affection, as they are of many other disorders, and therefore are not reliable signs. Epilepsy doubtless may be caused by meningeal thickening.

In regard to treatment little can be expected from drugs, so far as removal of the cause is concerned. The symptoms should be treated as they arise, and when they are localizing, as in Jacksonian epilepsy, opening the skull may enable the operator to destroy adhesions. It is questionable whether they will not form anew.

HYDROCEPHALUS

Hydrocephalus may be congenital or acquired. The congenital form may be the result of malformation of the brain during the embryonic period, as in porencephaly, sclerosis of a large part of the cerebrum, softening followed by contraction of tissue, proliferation of tissue around the foramen of Monro or about the aqueduct of Sylvius. When the inflammation occurs only about one foramen of Monro, the hydrocephalus may be unilateral, and the lateral ventricle on this side of the brain may be greatly distended. An inflammatory process about the aqueduct of Sylvius may lead to great distention of the ventricles of the cerebrum, except of the fourth ventricle, which may remain of normal size. Syphilis is a cause, and when it is congenital, may lead to hydrocephalus dating from the embryonic period. Rachitis may be followed by acquired hydrocephalus. Excessive transudation of fluid from the vessels of the meninges and those of the ventricles, or any obstruction to the circulation of the fluid, may cause hydrocephalus. A tumor producing much pressure is not uncommonly associated with hydrocephalus, and the author has known a new-growth of the cerebellopontile angle to cause hydrocephalus in this way, and the latter to obscure the symptoms of the tumor. Hydrocephalus is believed by some writers to result from systemic disturbances, as nephritis, severe anemia, cardiac lesions, etc. A cause too often ignored is meningitis, which, by occlusion of the foramina in the meninges, leads to obstruction in the flow of the cerebrospinal fluid, and to distention of the ventricles, causing symptoms appearing after an apparent recovery from the meningitis.

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* Spiller: Amer. Jour. Med. Sci., February, 1904, Case IV.

Where any cause can be found for the hydrocephalus, there is some indication for treatment, but the prognosis as regards cure is gloomy. Where syphilis is at fault, mercury and iodid may be employed, but the lesions in any case when recognized have probably assumed such intensity that destruction of tissue with formation of new tissue has occurred, and the hydrocephalus resists all therapeutic measures. Rachitis should be treated by nourishing and suitable diet, syrup of the iodid of iron, cod-liver oil, etc. Slight traumas of the head may have serious consequences in cases of hydrocephalus, as the bones are thinned and less capable of resisting blows. The falls, to which all children are liable, are especially serious when hydrocephalus exists. Any attempt to absorb fluid by the use of drugs will probably prove unsuccessful. Compression of the skull has been found to be of service in the opinion of some, but it is difficult to understand how the method could benefit the patient unless fluid previously had been removed. Occasionally spontaneous or traumatic escape of fluid through the skull has led to improvement or even cure. Puncture of the lateral ventricles has been considered by some a useful form of treatment.

Where the hydrocephalus is compensatory, as in porencephaly, removal of the fluid is not to be thought of.

SINUS THROMBOSIS

The causes of the marantic sinus thrombosis are numerous. Diseases of the blood which increase its coagulability, slowing of the circulation, and degenerative changes in the inner lining of the sinuses are among the most common causes. The clot is especially likely to form in the superior longitudinal sinus. The cerebral veins enter the sinus from behind forward in the direction opposite to the current of blood in the sinus. The trabeculæ within the sinus also favor the deposition of clot. Among the factors of disordered circulation are severe diarrhea, childbirth, anemia, chlorosis, and typhoid fever.

The symptoms are usually very indistinct, and no case of autochthonous sinus thrombosis, so far as the author knows, has been diagnosed during the life of the patient. There may be swelling of the cutaneous veins of the forehead and top of the head, convulsions, paralysis, contractures, aphasia, stupor, or coma when the superior longitudinal sinus is affected. If the cavernous and petrosal sinuses are thrombosed, there may be swelling of the eyelids on the affected side, exophthalmos, and weakness or paralysis of most of the cranial nerves on the same side. Hemorrhage often occurs secondarily to sinus thrombosis, and then the symptoms are those of cerebral hemorrhage, or acute hydrocephalus may result. The symptoms may resemble so closely those of meningitis that a differential diagnosis may be impossible.

When the lateral sinus is thrombotic, the clot may extend into the internal jugular vein, and this vein then may become prominent as a rigid cord. Edema in the region of the mastoid process is a common sign of this form of thrombosis. The thrombosis of the lateral sinus is more likely to be purulent, and to result from suppurative otitis media.

The treatment is most discouraging. Where some systemic condition exists, such as chlorosis, anemia, diarrhea, treatment should be directed toward the improvement of this condition. When the thrombus has formed, little is to be done by medicinal means. If cardiac action be weak, stimulants will probably be required. As hemorrhage is likely to follow thrombosis, leeches to the head or wet-cupping may be employed with advantage, but the general weakness of the patient is to be borne in mind and caution employed in withdrawing blood.

Purulent thrombosis demands operation and removal, if possible, of the portion of the sinus affected. Abscess of the brain is very likely to follow a purulent thrombus.

Diseases of the Brain

HYPEREMIA

Much more was attributed formerly to hyperemia than is customary at the present time. The pendulum has swung to the other side, and it may be it has gone too far. Inflammation of the brain (encephalitis) is now fully recognized, and yet hyperemia is the first stage of inflammation, and therefore must occur in the brain. Hyperemia of the brain is probably a part of hyperemia elsewhere in the body, and it is somewhat doubtful whether the circulation of the brain can be seriously disturbed for a long time, unless possibly by obstruction to the flow of the blood. The causes are excessive cardiac action, pulmonary disorders or disease of the mitral valve or of the right side of the heart, interfering with the circulation, fevers, possibly malaria, certain drugs, such as quinin or the nitrites, mania, excessive mental or physical exertion, sunstroke or even exposure to great heat, alcohol, chronic severe cough, pertussis, pressure upon the veins of the neck, sinus thrombosis, brain tumor, localized or general cerebral inflammation, etc. The hyperemia may be active or passive. Hyperemia probably causes headache, made worse by the recumbent position, tinnitus aurium, vertigo, possibly ataxia, sensation of fullness and soreness of the head, impaired cerebration, and even epileptoid attacks. The head may feel as though it would burst, the face may be red, there may be unusual mental activity; or, if the congestion become too intense, mental apathy, sleeplessness, disturbed vision, swimming of objects before the eyes, and headache may result.

The treatment consists in the administration of ergot, fifteen to thirty minims of the fluidextract three or four times daily, leeching at the back of the neck or temples—two or three leeches for children, eight to ten for adults. Wet-cupping and purgatives may be of service. Usually some systemic disorder will be found needing treatment, as the cerebral hyperemia most frequently is merely a part of a general hyperemia. Mental activity and excitement should be avoided. Light exercise is beneficial. Overeating or too rich food, champagne suppers, strong tea and coffee, all forms of alcohol, and excessive smoking should be avoided.

The greatest danger of cerebral hyperemia is cerebral hemorrhage or a form of epilepsy. So far as possible, chronic coughing or straining at stool should be prevented. Apoplexy has occurred while the patient was at stool, occasionally also during coitus. Tight clothing about the neck should be avoided. An ice-bag to the head may give relief. Cold baths, mustard foot-baths, draw the blood from the brain to the surface of the body. Very warm baths are not considered advisable. Eight, ten, or sixteen ounces of blood or more may be withdrawn occasionally, especially when the face appears much congested, the heart is strong, and the person is not advanced in years. The blood-pressure should be reduced, but it is a mistake to attempt the reduction of pressure from 180 to 125 or 130. A reduction to 160 may be accompanied by much improvement. Laxatives are of benefit, and constipation should be avoided. The bitter waters, Epsom salts, sodium phosphate, or citrate of magnesia may be employed. The kidneys should be kept active. Hypnotics in certain cases are needed, especially where there is excitement or convulsions, and of these veronal, trional, sulphonal, chloralamid, chloretone, may be used. Some persons are benefited by bleeding every month or so. When a person with congestion is unable to sleep, he should not be allowed to occupy himself with reading or writing during the time at night he is kept awake, as thereby he increases his tendency to wakefulness. A part of the wakefulness is the result of habit: the patient gets into the habit of awakening at a certain hour every night and of remaining awake a certain time. A hypnotic given just before bedtime and repeated four or five evenings in succession may break up this habit. Hypnotics should not be used frequently, as the patient will become dependent upon them, and they will eventually lose their power. The mind should not be actively occupied just before retiring. Sometimes a glass of warm milk at bedtime predisposes to sleep. Light exercise in the open air, riding, and sea air induce sleep. A heavy meal shortly before retiring should be avoided. The bromid salts are useful. An alcohol rubbing after the patient has retired may hasten sleep. Sleeping during the daytime, and tea and coffee, should be avoided.

ANEMIA OF THE BRAIN

What has been said of cerebral hyperemia is equally true of cerebral anemia, viz., that the condition rarely if ever exists alone, and is usually a part of a general circulatory disturbance. It may occur with general anemia from any cause, in the pernicious form as well as in less severe types; it may occur in leukemia, chlorosis, arteriosclerosis, or with diseases of the blood-vessels of the brain. Obstruction of the arterial cerebral circulation may be a rare cause. It is probable that the symptoms produced by thickening of the cerebral arteries are in a large measure the result of cerebral anemia, as the nutrition of the brain must be seriously disturbed by diseased vessels.

The symptoms are those of impaired cerebration, confusion of thought, and a mental complex in pernicious anemia, as shown by Pickett, resembling the Korsakoff psychosis. Tinnitus aurium and headache occur, and it may be difficult to distinguish the symptoms from those of cerebral hyperemia.

A distinction must be made between the acute and chronic forms of anemia. Fainting is caused by acute anemia of the brain from sudden impairment in the action of the heart. Acute anemia results also from sudden loss of blood, as after childbirth, surgical operations, or severe hemorrhages occurring anywhere in the body. It is part of a general anemia, but the cerebral symptoms may be the most pronounced. It may occur after removal of large amounts of fluid from the body, as in ascites. The attack, if not too acute, is accompanied by ringing in the ears, vertigo, darkness before the eyes, feeble pulse, and then loss of consciousness.

In the acute attack the flow of blood to the head should be encouraged by placing the patient in a reclining position, or even by having the head lower than the feet, and it may be necessary to maintain this position of the body several days. The clothing about the chest should be loosened so as to avoid compression, and respiration and cardiac action may be stimulated by dashing cold water in the face, by giving irritating substances to be smelled, as ammonia, spirits of camphor, etc. When the anemia is grave, artificial warmth should be employed, and pans of hot water may be placed in the bed. Cloths wrung out of hot water may be laid over the abdomen and chest. The faradic brush, or the rapidly interrupted faradic current applied to the skin, affords an excellent means of stimulation. Artificial respiration may be required in grave cases. The lower limbs may be bandaged in order to drive the blood toward the brain. Stimulants will often be needed, and for this purpose camphorated oil, ♏x to xv, atropin, gr. $\frac{1}{150}$, strychnin, gr. $\frac{1}{60}$ to $\frac{1}{40}$, every two or three hours, alternating, are of service. Nitroglycerin, gr. $\frac{1}{100}$, or tincture of digitalis, ♏x, or some other form of digitalis, or tinct. strophanthus, ♏x, may be employed to stimulate the heart. A hot-coffee enema is also of benefit in acute cases, and where much blood has been lost hypodermoclysis or direct injection of a normal salt solution into a vein is not to be neglected. Alcohol may be useful to build up the strength of the patient.

Where mitral stenosis or aortic stenosis exists, violent exercise should be avoided and the heart should not be greatly stimulated. It is well for one with chronic anemia to sleep with the head low in order to increase the flow of blood to the brain. The drain of nursing is very great on anemic mothers.

The treatment of chronic anemia of the brain is that employed for general anemia, viz., the administration of iron, arsenic in some form (as the cacodylate of sodium hypodermically), strychnin, quinin, the nitrites, etc. Improvement of the general health by proper exercise, nutritious food, and all measures that pertain to hygiene have a tendency to diminish the anemia.

CEREBRAL HEMORRHAGE, EMBOLISM, AND THROMBOSIS

It is impossible in many cases to make a positive diagnosis between cerebral hemorrhage, embolism, and thrombosis. Disease of the blood-vessels, arteriosclerosis, is the chief cause of hemorrhage and of thrombosis, and this vascular disorder is often associated with valvular disease of the heart, which is the cause of embolism. Embolism may occur from acute or chronic endocarditis, aneurism, or atheroma. Infected emboli may originate in malignant endocarditis.

Septic emboli are likely to cause meningitis. The symptoms are those of obstruction of the cerebral circulation; convulsions, paralysis, headache, confusion, stupor, more rarely delirium, nausea and vomiting, etc.,

Thrombosis may result not only from sclerosis of cerebral vessels, but also from weak action of the heart, and probably from alteration of the composition of the blood. In this way thrombosis may occur in typhoid fever.

One must not be misled by the slowness of the development of the symptoms into the belief that hemorrhage has not occurred. The leakage may be so gradual that hours may elapse before sufficient blood has accumulated to cause pressure. W. C. Krauss has reported a case in which about sixty hours after a fall from a trolley car disturbances of speech were first noticed, and it was not until the fourth day that Jacksonian epilepsy developed. A small hemorrhage of the cerebral membranes from a vein of the pia on the side opposite to where the blow was received was removed by operation. The hemorrhage had evidently been caused by gradual leakage.*

Prophylactic Treatment.—This may ward off for a long time a threatened rupture of the blood-vessels. Persons with thickened arteries, especially those who have reached or passed middle age, who have a rapid heart, and frequently present the appearance of vascular congestion, should be warned of the danger of apoplexy. Their lives should be so ordered that excitement and increased cardiac action are avoided as much as possible. They should be cautioned against climbing hills and long staircases, although exercise in moderation, such as does not send an excessive amount of blood through the diseased vessels, is desirable. People who are in danger of apoplexy are often high livers; indeed, this danger not infrequently has been caused by the excessive indulgence in food and alcoholic drinks. The diet should be regulated and alcoholic stimulants should be avoided, but if the heart be weak and the patient has become dependent on such stimulation, it may be necessary to diminish gradually the amount of alcohol. Heat should be avoided as far as possible, and if the patient has sufficient financial means, he should seek a cool climate during the warm months of the year. Anger may be a cause of increased cardiac action, and apoplexy has occasionally followed a severe manifestation of temper. Much can be done to avoid rupture of the vessels, but in spite of all care and foresight rupture may occur. Physicians seldom see an apoplectic attack in its commencement, and when they are called, the patient is usually unconscious. Drugs may be useful in the prophylactic treatment. Iodid of sodium, potassium, or strontium is a favorite remedy in arteriosclerosis, and probably is of service; nitrite of sodium or nitroglycerin, the latter in dose of $\frac{1}{100}$ gr., dilates the peripheral vessels and stimulates the heart. It is a matter of much doubt as regards the extent of improvement obtainable from the administration of these remedies. Where the vessels are greatly diseased, we cannot expect an iodid or nitrite to restore diseased tissue. There is a family tendency to arteriosclerosis, and the author has had a case of apoplexy in a man in whose family eight maternal aunts and uncles and his maternal grandmother had died of apoplexy. The tendency to vascular disease was evidently transmitted in this family. Intellectual work probably increases the danger of cerebral hemorrhage by causing an increased flow of blood to the brain.

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*Krauss: Amer. Jour. Med. Sci., September, 1904, p. 393.

Bleeding has been much abused, but in some cases it is of distinct service. The removal of eight to sixteen ounces of blood in a person who has signs of great cerebral congestion, viz., deeply injected face and sensations of fullness in the head and of dizziness with headache, numbness, and temporary weakness of one or more limbs, may ward off a threatened apoplexy. Care should be taken to avoid withdrawal of too much blood, as otherwise weakness may be the result. Where bleeding seems undesirable, as where the danger of hemorrhage is less acute but still present, aconite in small doses may accomplish much the same results by dilating the peripheral vessels and thereby bleeding a patient into his own vessels. The condition of the blood-pressure should be determined frequently.

Treatment of the Attack.—When the patient is seen soon after the apoplexy has occurred, treatment is less effective than when preventive measures are employed. Theoretically, effort should be made to arrest the hemorrhage occurring within the brain, but this is not easy to accomplish. Where the pulse is very full, eight to sixteen ounces of blood may be removed. It is questionable whether such bleeding is of benefit to the patient. The procedure is much recommended, but the vitality has already been reduced by the cerebral hemorrhage, and it is possible that the removal of blood from the peripheral circulation may further exhaust the patient's strength and carry him beyond the point of endurance.

Small doses of aconite may be used. Whether such procedures as friction of the extremities, mustard foot-baths, etc., accomplish much is questionable, but if they do not benefit the patient, they may to some extent relieve the mental strain of the anxious relatives, who feel that efforts are being made to save the patient. The bowels and bladder should be attended to. The latter may be much distended, and catheterization should be performed. Frequently involuntary micturition occurs, because the mental state of the patient does not permit him to control his sphincters. An enema may be given to evacuate the lower bowel, and croton oil, ½ to 1 drop with a little olive oil, may be placed on the tongue. It is sometimes difficult to get the unconscious patient to swallow, although if the stupor be not too great, deglutition is still possible. Where consciousness is only partially impaired, the bowels may be moved by small doses of calomel, by Epsom salts, or some other cathartic. The free movement of the bowels is desirable, as thereby depletion of the circulation is accomplished to some extent and the tendency to hemorrhage arrested. Elaterium produces watery stools and is desirable when the vitality is not too low.

The head should be raised and the patient should be placed in the most comfortable position by which free respiration may be secured.

The nutrition should be maintained by liquid diet, milk being the most valuable food. Usually the patient will be able to swallow fluid when it is administered to him by means of a feeding-cup; but where swallowing is difficult, nutrient enemas must be employed. Cardiac stimulants are not frequently required, at least in the acute stage of an apoplexy, but where the pulse is weak and the heart-sounds are feeble, moderate amounts of alcohol, caffein, camphorated oil, or other stimulants may be employed. Increasing the action of the heart increases the danger of cerebral hemorrhage.

If convulsions occur, they are not to be regarded as a reliable sign of extension of the hemorrhage into the lateral ventricles, and may be controlled by chloral hydrate in clyster, or by hypodermics of morphin. Convulsions may increase the bleeding within the brain.

After-treatment.—More can be done in the after-treatment of apoplexy than is usually recognized. The paralysis and contractures are to be overcome as far as possible, although in regard to the latter the treatment is more preventive than curative. The author has observed great improvement in hemiplegia occurring in childhood where the patient, an unusually intelligent girl, made all possible use of her paralyzed upper limb. She carried pails of water in the hand of the paralyzed side, in order that the muscles of the upper limb might not atrophy. Encouragement should be given to the patient to make use of whatever power is left, and the results will depend on the perseverance and intelligence of the patient and on the degree of original palsy in the limbs.

Massage and electricity are distinctly of value where the hemiplegia is not complete or at least not persistent as complete paralysis. As the extensors are more affected in the upper limbs and the flexors in the lower, the electricity and massage should be applied chiefly to these more weakened muscles. Even though the paralysis has existed many years, the systematic and proper application of electricity and massage may give marked results. If the paralysis be a spastic one, as so often is the case, there is a difference of opinion regarding the advisability of using massage and electricity; in flaccid palsy, however, most authors recommend their employment. By having a patient make voluntary efforts to contract a certain group of muscles at the same moment the electric current is passed over the nerve supply of this group, or when the movement is resisted by the hand of the examiner, it may be possible to increase the voluntary movements. The patient is inclined to use his better hand, as it requires patience to persist in the attempt to use muscles that respond poorly to volition, but he should be encouraged to use these weakened muscles so far as he is able. Passive movements are beneficial. They exercise the muscles, tend to prevent atrophy, and assist in overcoming contractures.

Where the flexor muscles in the upper limb are proportionately strong and the extensors are weak, nerve anastomosis has been attempted, but not with much success. It should not be employed until massage and electricity, applied only to the weaker muscles, have been given a fair trial.

APHASIA

The prognosis as regards aphasia depends upon—(1) The age of the patient at the time the aphasia develops; (2) the nature of the lesion within the brain; (3) the extent of the speech area invaded; (4) the representation of the speech function in each cerebral hemisphere; and (5) the intelligence and perseverance of the patient in treatment. In right-handed persons the left cerebral hemisphere contains the centers of speech; but if these centers be destroyed early in life, at a time when the brain is in a formative state, the right cerebral hemisphere can acquire the speech function. Therefore, it is exceedingly rare to find a right hemiplegia associated with aphasia if the cerebral lesion developed early in life. The character of the cerebral lesion has much to do with the prognosis of aphasia. Thrombosis is likely to cause permanent obliteration of the artery supplying the speech area (the middle cerebral), and therefore to cause persistent aphasia. Hemorrhage into the brain from spontaneous rupture of a blood-vessel may destroy so much brain tissue that there may be little reason to hope for restoration of speech. Trauma of the head may cause pressure upon the brain from a displaced piece of bone or from meningeal hemorrhage with edema, and in course of time the brain may accommodate itself to the altered conditions or the hemorrhage may become partly absorbed, and it is not uncommon to find that the aphasia in such cases has become very much less intense or has entirely disappeared after some months.

When the lesion is confined to a small portion of the speech area, the chances for improvement are far greater than when the whole speech area is involved. If Broca's area alone is destroyed, the condition is one of motor aphasia without sensory aphasia, although this is contradicted by Marie, and while the patient cannot speak, he has retained his receptive speech centers and can hear and understand spoken words and can read to himself. When sensory aphasia also exists and the avenues of approach to the speech area are thus blocked, little can be hoped for in the treatment of aphasia, provided the patient has reached adult life and the vicarious action of his brain has become less pronounced. Some individuals are endowed with a double representation of speech in the cerebral hemispheres, although the left hemisphere usually is the more active. A destruction of this left area may cause aphasia, at first complete, and later becoming partial as the right hemisphere assumes the function formerly exercised by the left.

All these factors must be taken into consideration in the treatment of aphasia, and in some cases, even in the adult, especially in those cases resulting from trauma, the author has known aphasia to entirely disappear without treatment. Where the injury of the brain is intense, the intellect becomes greatly impaired. As frequently we cannot decide at first how extensive the lesion is, it is well to make the attempt in every case to mitigate the aphasia. The reëducation of the patient demands the greatest patience and perseverance on the part of the caretaker. The aphasic individual is, so far as speech is concerned, much like a child, and must begin again to learn to speak in much the same way as does a child. He may learn simply by listening to those about him, and if he be intelligent and persevering, much may be expected. There are various methods which may be employed to assist the patients in reacquiring speech. These have been clearly and concisely presented by C. K. Mills, and I quote from his paper. Dr. Mills summarized the various pedagogic methods of treating aphasics as follows:*

1. The method of repetition after others which later becomes that of spontaneous recall as the patient improves; and allied or assisting methods, like reading aloud, copying and writing from dictation.
2. Phonetic methods, such as the method of the physiologic alphabet suggested by Wyllie and the use of phonetic readers.
3. The employment of vision to assist in the training, as when the aphasic imitates the movements of articulation, enunciation, and vocalization as made by others or by himself, in the latter case observing these in a mirror.
4. The retraining of the patients in the grammar of language when the aphasic is educated and when not, reorganizing so far as possible such language as he originally had.
5. Various special methods suggested by different authorities, as, for instance, that of Goldscheider, of training the patient to repeat meaningless syllables.

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* Mills: Journal of the American Medical Association, December 24, 1904, p. 1940.

Dana's * method of training aphasics is as follows:

1. Repeat five exclamatory words, such as: Ah, Oh, or another exclamation expressing joy, anger, or other emotion.

Repeat after the teacher ten single monosyllabic nouns and pronouns.

Repeat ten polysyllabic nouns.

Repeat ten verbs.

In these latter exercises, each time a noun is named, let the patient see the object, feel it, and see the written or printed name of it on a piece of paper before him, thus stimulating his visual, auditory, and tactile memories at the same time, as, for example: Watch; pencil; pen; cane; box; book; and so on.

2. Repeat the letters of the alphabet, these letters being held in front of him.

Repeat the letters of the alphabet after writing and looking at each one.

Repeat the figures up to ten.

Repeat while looking at the written figures in front of him. Write and repeat these figures.

3. Repeat ten simple, qualifying adjectives, such as: White; black; red; smooth; soft; rough. At the same time let him see the object and color, or feel the same.

4. Later let him try to repeat sentences of three words in which the noun is joined to the adjective, using the familiar nouns and the familiar adjectives already experimented with, thus: Pencil or pen is black; box is white; book is red; and so on.

5. If the patient ever had any musical capacity, have him sit at the piano and hum the notes of the piano, going through an octave, and then let him try to hum a tune, striking a note at the same time. Finally teach him to sing the tune through and then introduce the possible words. Some patients can sing before they can talk.

A PHYSIOLOGIC ALPHABET

I.—VOWELS.

y—i e a o u—w

These should be pronounced in the Latin manner, as *ee*, *eh*, *ah*, *oh*, *oo;* *y* and *w* are consonants, not vowels, but, as explained in the text, they have very close relationships to the vowels, initial *y* being very closely related to *i*, and initial *w* to *u*.

ILLUSTRATIVE SENTENCES

I.—VOWELS.

Even ancient leves are awed over oozing.

This sentence represents only long vowels. Their short equivalents can be represented, as shown by Mr. Pitman, by attaching the letter *t* to each vowel, thus:—

ĕĕt, it, et, at, ut, ot, ŏŏt.

II.—CONSONANTS.

II.—CONSONANTS.

	Voiceless Oral Consonants.	Voiced Oral Consonants.	Voiced Nasal Resonants.	
Labials. **(*1st Stop Position.*)**	***P*** (W)	***B*** W	M	**Peter Brown made w*h*ite wax.**
Labio-dentals.	F	V		**Fine villages.**
Linguo-dentals.	**Th^{1}** S	**Th^{2}** **Z**		**Thinkest thou so, zealot?**
Anterior **Linguo-palatals.** **(*2d Stop Position.*)**	**Sh** ***T*** (L)	**Zh** ***D*** L R	N	**Urely took down nine large roses.**
Posterior **Linguo-palatals.** **(*3d Stop Position.*)**	***K*** **H or Ch**	***G*** Y (R)	Ng	**Can Gilbert bri*ng* Lo*ch* Hourn youths?**

The voiceless *W* and the voiceless *L* have been given above within parentheses, the former being now almost confined to Scotland, and the latter being peculiar to Wales. The burring or uvular *R* is also given within parentheses.

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*Studies from the Department of Neurology, Publications of Cornell University Medical College, N. Y., 1904, vol. i.

6. Copy sentences made up of the words he is being taught. Let him have an ordinary copy-book and have the copy at the top of the page. Let him fill a page every day, trying at the same time to pronounce the words as he writes them. Have him copy first the familiar nouns, and then the simpler verbs, then the simple adjectives; finally let him copy sentences.

Take a small vocabulary and repeat from this, not trying to enlarge too soon.

7. Write the letters of the alphabet, and as he writes them, try to repeat them. Do this without a copy, if possible. Then let him write words to dictation, using the same vocabulary above referred to. Finally let him try to write short sentences to dictation, then try to read them after he has written them, with assistance at first, then without.

8. Write numbers up to twenty and say them out loud when written.

9. It would do no harm and might be of some benefit to try the effect of hypnotic suggestion in helping him to get along in these exercises.

10. The patient should allow himself to be read to for a short time twice a day, and he should also try himself to read a quarter of a page every day.

The phonetic methods of reduction, *i. e.*, the proper use of the vowel and consonant sounds and their combinations in particular ways, are employed by some in the treatment of aphasia. Mills thinks that undoubtedly a knowledge of the best method of producing and using special sounds and phonetic associations will be of value in the restoration of speech lost by an adult, or even by a child, as it is in the primary education of a child. In speaking of Wyllie's* physiologic alphabet, accompanying this article, he says:

In this physiologic alphabet the exact methods of forming and using both vowels and consonants need to be understood. A little practice, however, and the knowledge of the principles of the formation of these sounds, as described by Wyllie, will enable this to be done. He discusses at length the manner in which the consonant sounds are formed by the movements and positions of the lips, teeth, and tongue. He especially considers the so-called stop positions resulting from placing the tip of the tongue at various points, as on the teeth, and anterior, middle, and posterior locations as regards the roof of the mouth. In each of these positions certain sounds, labial, labio-dental, linguo-dental, anterior linguo-palatal, and posterior linguo-palatal, are formed by the action of air passing through the oral cavity and outlets. Practice with the table and the illustrative sentences given in it, or with others which can easily be formed on the evident principles involved, will soon familiarize one with the methods of its use even without an understanding of all the technicalities in the production of voice.

With regard to motor aphasia and the method of training by repetition and by the phonetic method, Wyllie says that it is often advantageous to have the patient repeat spoken words, and he holds that it is largely in this way that he reacquires his speech. He believes, however, that the process can be much expedited by having the patient in the first instance master the simple letter sounds, such as are explained in connection with the discussion of his physiologic alphabet.

Mills believes in the use of primers and grammars in the retraining of aphasics, and he thinks that these, with individuals previously reasonably educated, are of great value. He believes that the patients should be taught the grammar as a child is instructed; in other words, by teaching him the meaning of the different parts of speech and the exact methods of using them in phrases and sentences. The significance and value of the qualifying, relating, and conjoining parts of speech should be enforced by numerous examples. When the aphasic, in his efforts to repeat after another or to respond to what another asks or indicates, uses incomplete sentences, the complete sentences should be given and explained. In every possible way the manner of using adjectives, prepositions, conjunctions, and auxiliaries should be impressed. The patient with the book before him should be taught to conjugate verbs, decline nouns and pronouns, compare adjectives, and in other ways to go through the routine methods of studying language employed in the schools, these being modified by the particular requirements of the case. The dictionary can often be used as a valuable adjunct to the grammar, some patients taking a particular interest not only in reacquiring words in this way, but in thus learning their meaning and their uses as parts of speech.

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* Wyllie: "The Disorders of Speech."

In the treatment of motor aphasia Gutzmann begins by teaching the lip sounds, the vowels, first a, which causes the mouth to be widely opened, then o, then u, then e, and then i. The patient must observe carefully the mouth of the teacher while he is speaking, in order that he may imitate the positions of the mouth, but in addition to this he must observe his own mouth in a looking-glass while he is speaking. After the vowels have been learned, the explosive sounds are practised, and first of all the letter p. As the lip movements are usually affected in aphasics, the attempts to say the letter p give the lips practice and make other letters easier. The p and a are combined and the patient is taught to say pa, and then po, and pe, and then to say them together pa pe, or pa po pe. The acquiring of the letter p brings with it the letter b. Nasal sounds are difficult, as m. F and v also cause much difficulty. The letters in the order they are learned are t, d, k, g, n, s, sch, ch, j, r, although variations are permissible, and those sounds which seem easiest to the patient should be practised first. Attempts to write with the left hand should be made early, as this assists in the acquiring of speech, and the written word makes a deeper impression upon the memory. Attempts to read should be begun early also. The letters should be shown separately to the patient, and then some word with which he is familiar, and the object the letters spell may be shown; in this way an association of ideas is formed. Gutzmann believes that observation by the aphasic of the person speaking aids much in the acquiring of language, and he refers to the fact that if at the opera a singer is watched through the opera-glasses, the words sung may become more distinct. He also employs a phonetic alphabet.*

The methods used in teaching foreign languages in certain schools may be employed in training aphasics. These consist of frequent repetitions of a sentence, the showing of an object when that object is named, of illustrating the meaning of a sentence by the action of the speaker, etc. Those who have lived in a foreign country, the language of which was previously unknown to them, have realized how much they have learned by the constant hearing of words and sentences and attempts on their own part at speaking. A child always learns faster than an adult. The aphasic is at a disadvantage in that he has an intellectual deficit. The child in being taught to read is given a book containing simple sentences, such as: "This is an apple." The picture of an apple appears near the sentence, and the words of the sentence are given both in script and in printing. A similar method can be used with advantage in training aphasics.

ACUTE ENCEPHALITIS

The acute, non-purulent form of encephalitis has been the subject of much study in recent years. It is usually caused by infection. The diagnosis from meningitis and sinus thrombosis is exceedingly difficult, and indeed the inflammation of the brain is not uncommonly associated with inflammation of the pia. The treatment recommended for meningitis may be employed in cases of encephalitis, and the physician will often be uncertain whether he is treating encephalitis or meningitis, or both.

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* Gutzmann: Archiv für Psychiatrie, vol. xxviii, p. 354.

ABSCESS OF THE BRAIN

A "running ear" is not infrequently the source of abscess of the brain, and should always be thoroughly treated. It is occasionally regarded as a matter of slight importance, and may exist for a long time without causing serious symptoms, but the author has known metastatic cerebral abscess to develop after purulent otitis media had existed for decades. The preventive treatment of cerebral abscess as applied to the ear is therefore of great importance. Abscess of the brain may be secondary to purulent processes in the lungs, such as chronic purulent bronchitis, and little can be done to ward off the danger of cerebral abscess when it is present in this form. Any purulent foci in the body may be the source of metastasis to the brain, but those of the lungs, for some reason that has not been satisfactorily determined, are especially likely to be so.

After abscess has formed in the brain surgical treatment alone is to be considered. It is extremely dangerous to wait, hoping the discharge may occur spontaneously, through some of the sinuses of the cranium, by erosion of bone, or in any other way. There is much danger of an abscess within the brain extending to the surface and causing purulent meningitis. The same danger exists after operation, and it has seemed probable that the extensive washing of the brain, which is done sometimes at the time of operation, may spread the purulent process. A moderate washing seems, however, to be necessary, because in no other way can the thick pus be removed. Aspiration of a collection of pus within the brain is unsatisfactory, because the pus often is so thick it will not flow, and when aspiration is attempted, much pus is left behind. Methods of operation, however, must be discussed elsewhere. The greatest danger from cerebral abscess is the development of a secondary purulent meningitis.

Abscess secondary to trauma of the head occurs, but is not so common as that following purulent middle-ear disease.

Wounds of the head should, of course, be treated aseptically.

Wherever the symptoms of brain abscess are present, the surgeon will do well to explore the cranial cavity, as he dare not hope for relief otherwise. The symptoms on which he must depend are those of increased intracranial pressure, viz., headache, vertigo, nausea and vomiting, choked disks, convulsions, and stupor. Often several of these symptoms are wanting. Convulsions, nausea, vomiting, and vertigo are much less common than in cases of brain tumor. Choked disks are frequently found and may be of high grade. A subnormal temperature or a moderate elevation of temperature, slowing of the pulse and of respiration, with stupor, are very suggestive of abscess. Chills not infrequently occur.

There will often be much difficulty in deciding where the surgeon shall operate. The temporal lobe and cerebellar hemisphere are the most common seats of abscess when it follows middle-ear disease, and the collection of pus is more likely to be in the former position. If the left temporal lobe be the seat of the abscess, symptoms are more distinct than when the abscess is in the right temporal lobe. Most people are right-handed, and therefore we may look for word-deafness if the left temporal lobe be affected. As the abscess not infrequently is below the first temporal convolution, and sometimes below the second temporal convolution, sensory aphasia, as shown by word-deafness, may be absent. In such a case the diagnosis of location will be almost as difficult as when the pus is in the right temporal lobe. When the process has reached a certain stage, pressure upon the motor tract within the brain is likely to occur and cause weakness of the limbs on the side opposite to the abscess. Hemianopsia is a rare sign of abscess, as usually a fatal termination results before the pus extends so far toward the center of the brain as to involve the optic radiations, but it occurred in a case reported by Mills and Spiller.

Abscess of one of the lateral lobes of the cerebellum is likely to cause ataxia, vertigo, headache, and some alteration of the patellar reflexes, usually a diminution or loss, but the abscess may form so gradually that the functions of the cerebellum are little disturbed and time is given for readjustment of function.

When the primary lesion is in the ethmoid sinuses, the frontal lobe is more likely to be the seat of metastatic abscess, and the diagnosis of location is not easy because symptoms of a frontal lobe lesion may be difficult to determine.

In diagnosing cerebral abscess the discovery of a purulent focus somewhere in the body is of much importance, especially when it is in the head or lungs. When in the former place, the cerebral abscess is likely to be near the superficial abscess. A history of trauma of the head is likewise valuable, as all evidence of external injury may have disappeared. It is uncertain how long a cerebral abscess may remain latent. If well encapsulated and of slow development, it probably may exist a long time before symptoms become manifest, the appearance of symptoms depending also on the situation of the abscess; certainly the external suppurative process may last many years before symptoms of cerebral abscess are recognized. Cerebral abscess is not so common after acute otitis media as it is following the chronic process.

Acute otitis media, however, may cause symptoms of cerebral abscess. The author has known violent headache, nausea, and vertigo to develop within a day or two after rupture of the tympanic membrane while bathing in the ocean, followed by purulent otitis media. Under such circumstances the patient should be kept quiet, he should be prevented from mental work so as to lessen the tendency to hyperemia of the brain, and a watch should be kept for symptoms of cerebral abscess. Evacuation of the pus from the middle ear may lessen or cause the symptoms to disappear, but if they persist for several weeks after evacuation, intracranial abscess must be feared.

Extradural abscess following middle-ear disease is to be diagnosed by cutaneous edema, abscess, or swelling behind the ear, tenderness on pressure, etc.

Secondary to middle-ear disease there may be purulent meningitis, external pachymeningitis, or thrombosis of the lateral sinus.

The diagnosis between cerebral tumor and cerebral abscess is one of great difficulty. Henschen makes the following distinctions:

Head injury followed by a purulent process, erysipelas, or fracture of the skull indicates abscess, especially if the cerebral symptoms develop within a few days or a few weeks after the injury. Injuries of the head, with slight or no cutaneous lesions, followed after several months, or one or more years, by localized twitching, later Jacksonian epilepsy or general epilepsy, indicate tumor. Slow development of symptoms, slowly increasing cranial pressure, indicate tumor; rapid development indicates abscess. Fever with or without chills is suggestive of abscess, although fever may accompany tumor. Tumors seldom give signs of localized inflammation, abscesses often do. Optic neuritis is common with tumor, but seldom is intense with abscess, develops rapidly, and does not disappear until several months after the abscess has been evacuated. It may develop with purulent otitis media as a result of meningitis, extradural abscess, phlebitis and sinus thrombosis, and leptomeningitis. Symptoms indicative of lesion in the temporal lobe or the cerebellum when purulent otitis media exists are strongly suggestive of abscess, especially when signs of infectious intracranial irritation are present. Sometimes pus can be detected flowing through the tegmen tympani.*

While in general these distinctions may be regarded as excellent, too much importance must not be placed upon them. More valuable of all signs probably are those indicating a lesion of the temporal lobe or cerebellum, with slow pulse and slightly abnormal temperature, rapid wasting, and the presence of purulent otitis media.

The cerebrum is much more frequently the seat of abscess than the cerebellum,

While in general an abscess should at once be evacuated when the diagnosis is made, frequently delay is necessary before a correct diagnosis is possible. The headache may be lessened by an ice-bag to the head, by the administration of acetanilid, antipyrin, phenacetin, morphin, etc. A few leeches behind the ear may relieve congestion and afford relief. Vomiting may be controlled by swallowing small pieces of ice, by champagne, by small doses of the spirits of chloroform or of cocain hydrochlorid.

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*Henschen: "Handbuch der Therapie innerer Krankheiten," third edition, vol. vi, 1903.

CEREBRAL SYPHILIS

In this section only syphilis as it affects the brain will be considered, although the spinal cord is usually diseased when the brain is attacked.

Symptomatology.—The symptoms of syphilitic infection of the brain may develop within a few months or within a few years after the primary infection, and may closely resemble those of tumor. There may be headache, nausea and vomiting, choked disks, general convulsions, vertigo, stupor or coma, as general symptoms of increased intracranial pressure; and in addition localizing symptoms, as Jacksonian epilepsy, hemiplegia or hemiparesis, and paralysis of cranial nerves, especially of those controlling the muscles of the eye. The symptoms are frequently indicative of multiple lesions, and therein lies one of the most diagnostic features of cerebral syphilis. The author has seen paralysis of the muscles of mastication with intense fibrillary tremors as a sign of syphilitic involvement of the motor branch of the trigeminal nerve, or intense tic douloureux as a symptom of the involvement of the sensory branch. The oculomotor palsy is so common in cerebral syphilis that when this exists antisyphilitic treatment should be tried. Cerebral syphilis is, of course, most frequently seen in adults, but occasionally is acquired by children, although in them it is more likely to be hereditary. In foreign countries, where wet-nurses are commonly employed, the danger of communicating syphilis to the infant is not inconsiderable, especially as the women employed for this purpose often have led loose lives. The headache may be persistent, and worse at night. Syphilis occasionally appears where least expected, and it is a good rule, in any case where the symptoms are suggestive of the disease, even though the Wassermann reaction may be negative, to give the patient antisyphilitic treatment, at least for a period sufficiently long to afford a therapeutic test. It must not be forgotten, however, that improvement under the administration of mercury and iodid is not a proof of the syphilitic nature of the process.

It is the opinion of some that if the syphilis be not vigorously treated in the early stages of infection, the danger of implication of the nervous system is greatly increased, but the correctness of this view is difficult to establish. Trauma of the head probably increases the tendency to cerebral syphilis, possibly by lessening the vitality of the part, and thereby diminishing the resistance. Alcoholism also may increase the danger of cerebral manifestations of the disease in persons who have acquired syphilis. Usually an interval of two or three years passes after infection before the signs of syphilis of the nervous system appear, if they appear at all. The history of miscarriage or the failure of pregnancy is suggestive of syphilis. Hemiplegia occurring in the young is frequently the result of cerebral syphilis.

The common lesion of cerebral syphilis is not the gumma. The idea is firmly impressed upon the minds of many that when an individual shows cerebral symptoms of syphilis and gives a history of having contracted the disease, he has a gumma of the brain. A large gummatous tumor is rather a rare growth of the brain, and during several years the author has impressed this fact upon students in his lectures to them. Walton and Paul have made a similar statement. "It is interesting," they say, "to note the infrequency of the diagnosis gumma in recent reports. In fact, this diagnosis does not appear at all in the series of Blackburn, nor does it appear in the Massachusetts General Hospital records since 1896."*

Contrary to the opinions of some physicians, the common lesions of cerebral syphilis are arteritis and meningitis. The vessels, especially those at the base of the brain, are much thickened, and the intima is usually most affected. The lumen may be almost or entirely occluded, and as a consequence the circulation in the part of the brain supplied by these diseased vessels is cut off, and softening of tissue results. As the motor tract is likely to be implicated in the softened area, hemiplegia is common with cerebral syphilis. The pia-arachnoid, especially at the base around the cerebral peduncles, is much thickened and infiltrated with round-cells. These may be exceedingly numerous. They are small cells containing single nuclei and little protoplasm. The accumulation of these about the cranial nerves interferes more or less with the functions of the nerves, and as they are usually very abundant about the oculomotor nerves, the oculomotor palsy is very common with cerebral syphilis. Occasionally localized symptoms may result from a meningitis of this character, but more frequently they are indicative of a diffuse process. Usually there is more or less encephalitis associated with the meningitis, and the latter may be of a gummatous character.

Treatment.—Treatment can accomplish much if the cerebral syphilis be seen in the early stages, but little if degeneration of the blood-vessels has become intense, and softening and sclerosis of the brain have occurred. Probably the danger of cerebral involvement cannot be warded off by any known treatment. It is possible, indeed probable, from certain investigations, that where the symptoms of general syphilis have been slight, the danger of cerebral involvement is increased. It is likely that in such cases an antisyphilitic treatment has not been employed early and vigorously. The evidence seems to show that vigorous and early antisyphilitic treatment lessens the danger of implication of the nervous system.

Mental activity probably increases the danger, and the intellectual are not infrequently the subjects of cerebral syphilis or general paresis, a parasyphilitic disease.

Until recently nothing had been found to take the place of mercury and the iodids in the treatment of syphilis. Opinion is divided as to whether these drugs should be given together or whether the mercury should first be administered, and after a few weeks be followed by iodid. The author prefers the administration of mercury alone.

The question as to the time antisyphilitic treatment should first be employed after the infection will be discussed elsewhere, but the earlier it is begun after the diagnosis is made, the better. If the patient comes to the dispensary and therefore is not under the watchful eye of the physician, it is better to employ smaller doses than when the physician can visit the patient at his home or at a hospital as often as he may deem desirable. In the first instance it is well to begin the treatment with half a dram of unguentum hydrargyri daily; in the other case a dram may be employed. This should be rubbed into the body by the patient himself, if that be possible, and at least thirty minutes should be consumed in the rubbing. A warm bath taken previously to the rubbing is advisable, as in this way the pores of the skin are opened and absorption is increased. A part of the body should be selected on which is as little hair as possible and a new place should be chosen each day for several days. One application daily is usually sufficient. Where the symptoms are threatening, two drams may be employed daily. The inunctions should be continued for two or three weeks or longer, or until constitutional symptoms appear: salivation, gastro-intestinal disturbances, etc. A mouth-wash of some antiseptic solution, as a solution of thymol, or a 4 or 5 per cent. solution of chlorate of potassium, should be employed. The mercurial inunctions are excellent in cases of cerebral syphilis, but there are those who prefer the hypodermatic injection of the bichlorid, the salicylate, or some other form of mercury, or the administration of some salt of mercury by the mouth. In certain parts of Europe a mercurial soap is much used, but this is not readily obtained in this country. Iodid of sodium or of strontium is preferable to iodid of potassium, and treatment may be begun with a dose of ten minims of an aqueous solution containing one grain to a minim three times daily, increasing by five minims daily until the patient is taking sixty or even one hundred grains of iodid daily. Where three hundred grains of iodid fail to benefit, larger doses probably will not be of service, although some physicians recommend the administration of six hundred grains daily. The response to treatment with large doses of iodid is sometimes very marked, even when no result has been obtained by small doses.

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*Walton and Paul: "Journal of Nervous and Mental Disease," August, 1905, p. 484.

Where mercury and iodid fail to benefit, they should be discontinued at once. In some cases, especially when the diagnosis of syphilis is incorrect, these drugs diminish the vitality of the patient and tend to put him into a cachectic state.

Bromids or chloral may be needed to control the convulsive attacks, given in thirty grains or more of the former to ten or fifteen grains of the latter two or three times daily. Trional or one of the hypnotics may be needed to procure sleep; antipyrin, acetanilid, phenacetin, bromids, may be needed to combat the headache.

During the first year it is well to repeat the mercury and iodid treatment two or three times over a period of four or five weeks, and every year afterward once or twice yearly for four or five years, even though no symptoms may have returned.

Where this treatment proves useless, it is well to resort to a general tonic treatment, such as the glycerophosphates, hypophosphates, certain forms of iron, arsenic, strychnin, etc.

The administration of dioxydiamidoarsenobenzol ("606") has produced some remarkable results in the treatment of cerebral syphilis, and cacodylate of soda has also proved to be of use. Where mercury cannot be used, the latter sometimes may be employed advantageously by hypodermatic injection in ¼ grain doses every other day, or less frequently.

Where a gumma of the brain develops, surgical intervention may be necessary, and this will be considered under the subject of tumors of the brain.

TUMORS OF THE BRAIN

Symptomatology.—Symptoms of cerebral tumor are of more localizing value when they appear early in the symptom-complex; when they appear late, they may be misleading. Paralysis of a sixth nerve, if of early development, probably indicates some involvement of this nerve in the primary intracranial lesion, but if it develop after the symptoms of intracranial pressure have become marked, it may be the sign of some remote pressure, as of a tumor of the parietal lobe. Bilateral paralysis developing early points to a lesion at a part where the motor tracts are near together, as at the base of the brain, and the association of other signs permits the proper diagnosis of location. Bilateral palsy, developing late, may be caused by internal hydrocephalus, and it may develop when the tumor is in the cerebellopontile angle and causes pressure upon the fourth ventricle. Tumors in almost any part of the brain may cause late symptoms suggestive of basal involvement. Collier has paid much attention to these false localizing signs. He has observed nerve-deafness of the left ear, paralysis of the left external rectus, and left peripheral facial palsy as signs of a glioma of the left prefrontal region. If one had depended upon these as localizing signs, he would have suggested operation at the base of the brain, and would have made a serious, possibly fatal, mistake; whereas if they had been early signs, an operation at the base would have been justifiable. Collier* has seen Jacksonian epilepsy occurring late as a result of a cerebellar tumor, and has found false localizing signs in twenty cases out of one hundred and sixty-one. Whether we can or cannot accept Collier's explanation for these false localizing signs, further study must show. He believes that late paralysis of cranial nerves is caused by the shifting backward of the brain-stem from supratentorial pressure, and traction in this way upon the cranial nerves. He has found slight weakness of the lower part of the face very common from supratentorial tumor in any part. The weakness of the facial nerve supply is one of the most reliable localizing signs if it occur among the early manifestations. In association with other symptoms, it may lead to a diagnosis of tumor near or in the cerebellopontile angle when there is no involvement of the acoustic nerve.

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* Collier, Brain, Winter, vol. xxvii, 1904, p. 490.

Souques has advanced a remarkable theory which needs verification. He believes that rapidly growing brain tumors may, by increase in pressure of the cerebrospinal fluid, cause deafness in much the same way as blindness is caused by swelling of the optic nerves. He thinks deafness would be found a more common sign of brain tumor if it were sought for. The examination of cases of brain tumors has not shown deafness as a common sign, and the author would be much inclined to regard it as of localizing value if it could be shown to be of nervous origin and to have developed with the other signs of tumor.

Jacksonian epilepsy is a sign often of localizing value, but may be misleading. It is true that many cases of idiopathic epilepsy are of the Jacksonian type; that is, the spasm begins in one and the same part of the body every time. If attention be paid to the manner in which convulsions start, often it will be found that the twitching is first seen in the hand or in the head, but then the spasm rapidly extends to other parts of the body, and within a few minutes the whole body is in convulsions. Jacksonian epilepsy may be caused by fracture of the skull, or of the inner table alone, by meningeal hemorrhage, simple or purulent pachymeningitis, contusion or hemorrhage of the brain, bullet or stab wound, syphilitic circumscribed meningitis, gumma, chronic meningo-encephalitis (syphilis or paretic dementia), multiple sclerosis, porencephaly, encephalitis, thrombosis, uremia, lead encephalopathy, alcoholism, diabetes, arteriosclerosis, carcinomatosis without carcinoma of the brain, tuberculosis, etc. It seems remarkable that a general cerebral disorder could cause Jacksonian convulsions, and yet the author has known this to occur when both cerebral hemispheres were studded by miliary tubercles and apparently equally affected. Toxic conditions, such as occur in uremia or carcinomatosis, are known to cause it.

Notwithstanding these statements, a distinct manifestation of Jacksonian epilepsy is usually to be regarded as a valuable localizing sign. Where a spasm is persistent and always begins in the same hand or foot, and does not extend beyond this part, or at least not rapidly to the other side of the body, and occurs very frequently, operation may be advised. A lesion of some sort is likely to be found in or near the center for the affected limb, and there is always a possibility of removal of this lesion by operation. When other symptoms are associated, as choked disks, weakness of the parts involved in the convulsions, etc., the propriety of operation is still more evident. The author has seen a small tumor uncovered and removed from the motor area when the only sign of the growth was a spasm confined to the upper limb of one side and to the face. Had operation in such a case been postponed, the tumor would have grown much larger, and the brilliant result obtained by removal would not have been possible. Of course, a careful examination of the urine should be made in every case of Jacksonian epilepsy, and if signs of nephritis be found, the nephritis should be treated. The author can recall a case, seen some years ago with others, in which a certain form of sensory aphasia, persisting for weeks, seemed to demand an exploratory operation. Several examinations of the urine had revealed nothing abnormal. On the day before the one fixed for operation albumin was found. The operation was postponed and the patient made a complete recovery from his sensory aphasia without operation.

Loss of smell is very unreliable as a localizing sign. In one of the author's cases sense of smell disappeared early and a tumor was found upon the pons and extending downward upon the spinal cord. The olfactory bulbs are soft, and any marked increase of intracranial pressure may disturb the function of these parts.

The inadvisability of hasty operation in every case of suspected brain tumor has been shown by the investigation of Nonne. He has found that symptoms universally recognized as those caused by brain tumor may disappear without operation, and the patients may remain well. These cases cannot be regarded as syphilitic. We know that syphilis may give the signs of brain tumor in so striking a degree that a correct differential diagnosis may be impossible. In some cases reported by Nonne the necropsy afforded no explanation for the symptoms; and anemia has been regarded as a possible cause. Chlorosis has been known to give the symptoms of brain tumor. If syphilis may cause the signs of brain tumor* which may disappear under proper treatment,—and the correctness of this statement no one will dispute,—then other cerebral lesions, as serous meningitis, may give similar symptoms.

The diagnosis of the side of the cerebellum affected by a cerebellar tumor is often very difficult. We may be reasonably sure that a tumor is in the cerebellum, but we may find it impossible to say on which side it is. Hemiataxia without disturbance of sensation is believed by Mann† to indicate that a tumor is on the side of the ataxia. It has been supposed that hemiasynergy is also a localizing sign of tumor and that it occurs on the side of the tumor. It may be tested by having the patient flex the lower limbs as far as possible, and if present, will be shown by a want of synergy in the extension of the leg on the thigh and the thigh on the abdomen.

Oppenheim's‡ sign of loss of the corneal and conjunctival reflex, with or without anesthesia of the cornea and conjunctiva, is of value, but is not always present.

Too much space cannot be given here to the diagnosis of brain tumors, and the reader is referred to the many excellent text-books in which this subject is discussed. The general symptoms are headache, nausea, vomiting, convulsions not Jacksonian in type, choked disks, and vertigo, although all of these are not present in every case. Properly to appreciate the localizing symptoms one must be familiar with cerebral localization.

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* Nonne: Deutsche Zeitschrift f. Nervenheilkunde, Nos. 3 and 4, vol. xxvii, p. 169.

† Mann: Monatsschrift für Psychiatrie und Neurologie, June, 1904, p. 409.

‡ Oppenheim: Berliner klinische Wochenschrift, April 10, 1905, p. 448.

Treatment.—The treatment of brain tumors, aside from surgical measures, is unsatisfactory, because no permanent relief can be expected as long as the tumor remains. Mercury and the iodids are of great service in the treatment of cerebral syphilis, but they cannot remove a gumma of the brain. In cases of cerebral syphilis where these drugs accomplished brilliant results it is probably by their action on meningitis and arthritis. It is not probable they can cause the disappearance of a large syphilitic tumor, although unquestionably they can improve the condition of cerebral syphilis. The symptoms of other forms of tumor, glioma, etc., may disappear under the administration of mercury and the iodids, and the disappearance is not a proof of the existence of cerebral syphilis.

Removal of the tumor by surgical means is not always possible, because the diagnosis is too uncertain, or the tumor is too deep or is too large. A tumor may grow so slowly that the symptoms may be very indistinct. In cases such as these, symptoms must be treated as they arise. The headache, nausea and vomiting, vertigo, will need attention, and the treatment is that which is applicable to these symptoms, no matter what may be the cause, but decompression often is advisable. If cerebral congestion be present, wet or dry cups behind the ear, or even bleeding from the arm, may be desirable; but this form of treatment is seldom employed in brain tumor. Bromids, ten to twenty grains, two or three times daily, and the salts of sodium, strontium, or potassium, may be used. An ice-bag to the head may give relief. The coal-tar preparations, acetanilid, phenacetin, or morphin, when necessary, may be employed.

Sleeplessness is not usually a prominent symptom, as more frequently the condition is one of stupor, but when it is present, it may be treated by any of the hypnotics, trional, chloral, sulphonal, chloretone, veronal, etc.

The nausea and vomiting may be controlled by giving the patient small pieces of ice to swallow, by champagne, by spirits of chloroform, by drop doses of carbolic acid, by small doses of hydrochlorid of cocain, morphin, etc.

The vertigo is sometimes very obstinate and resists all treatment, as may also occasionally the other symptoms, although they may yield to mercury and the iodids.

Trauma of the head frequently precedes the symptoms of cerebral tumor, and probably may increase the growth of a tumor and intensify its clinical manifestations.

The nasal sinus should be investigated in a doubtful case, as disease in these parts may cause some of the symptoms of tumor.

Convulsions may be controlled by bromid alone or in combination with chloral hydrate, twenty grains of the former to ten or more of the latter; by chloretone three to five grains once, twice, or three times daily.

Optic neuritis, when due to tumor, can be treated only by relief of intracranial pressure. The question of operation is one associated with much difficulty. It is impossible to obtain accurate statistics because, as a rule, the unfortunate results are not published. Many a brain tumor may exist for years before it causes death, and there is not the slightest doubt that in many cases operation has lead to a rapidly fatal termination. In some instances it is impossible to say before operation is performed whether the tumor be removable or not; in other cases we may be very certain that the growth cannot be removed. A tumor may be present and may grow so slowly that it causes few symptoms. In every case we may be sure that we have to deal with a lesion that sooner or later will cost the patient his life, and we shall be persuaded frequently to make the attempt to prolong life. A tumor of the cerebellum is especially likely to cause a fatal termination without previous warning. The patient may not be any worse than he has been for days, and suddenly present grave symptoms and die within half an hour, or he may recover from several attacks. The danger of these attacks should always be borne in mind, and the friends of the patient should be warned beforehand. They are more likely to occur when the tumor is in or near the cerebellum, but are not produced only by tumors of this part.

If we were in a position, from the symptoms presented by the patient, to determine, before operation, the nature of the growth, we could form a better judgment as regards the advisability of operation, but usually we have no means of determining this. Certain tumors from their character alone are inoperable. A glioma cannot be entirely removed unless it be small, and it is questionable whether in most cases it would not be better to leave a large infiltrating tumor untouched if we suspect it to be glioma, which we can hardly do until the tumor is exposed. This variety of tumor is usually infiltrating, is very vascular, and the removal of a part seems to increase the vascularity of the remaining portion, and to hasten the growth in this way and by affording more space for its development. A sarcoma, especially an endothelioma, is more favorable for surgical intervention. It is a very malignant tumor, but fortunately often, although not always, is encapsulated and often compresses without infiltrating the brain. After removal it may not return for four or five years or longer, but is likely to recur sooner or later. If these tumors, when in accessible positions, could be operated upon early, the results of surgical intervention would be much more favorable than they are at present. Unfortunately, the diagnosis can be made in most cases only after the tumor has attained considerable size. A fibrosarcoma is less malignant than a softer form of sarcoma. A fibroma is of rather slow growth, is not infiltrating, usually is loosely attached to the brain, and in these respects is favorable for operation, but unfortunately is situated in many instances at the base of the brain, in the cerebellopontile angle, and therefore is removed by operation with great difficulty. Mallory regards this tumor as endothelioma. It is likely to grow from the acoustic nerve, and once removed, may not recur. It may be a part of the fibromatosis of the nervous system, in which case multiple fibromas may be found at the base of the brain and on the nerve-roots of the spinal cord, and the symptoms may be only those caused by the tumor of the cerebellopontile angle.

A gumma may be very small, causing few symptoms, or may extend through the skull and reach the surface, and such a tumor may afford an opportunity for easy removal, and recourse should be had to the knife. Lipoma, cholesteatoma, psammoma, are all very rare forms of cerebral tumors. A tumor growing from the dura is likely to be a sarcoma, especially an endothelioma, is usually very vascular, and the attempt to remove it may cause severe hemorrhage. So far as the brain is concerned, it affords a favorable opportunity, as it usually compresses this organ without infiltrating it, but even in the motor area these tumors may grow to large size without causing distinct symptoms. Tubercle is not a rare form of tumor, but it is not very favorable for operation, as it is likely to be part of a tuberculous meningitis.

A tumor may be correctly diagnosed and yet not found at operation; this may be because it is subcortical, or because it is a little behind or in front of the region in which it is supposed to be. Thus a tumor in the frontal lobe may, by pressure upon the motor area, cause hemiparesis or hemiplegia and unilateral convulsions. If only the motor area be exposed, the tumor may not be found. Tumors that lie deeply within the brain cannot be removed by operation.

It is to be remembered that opening of the skull is often of great benefit even when the tumor cannot be removed, as in this way intracranial pressure is relieved. The general symptoms of tumor may be greatly lessened by diminishing the intracranial pressure, and even vision may be retained, although impaired. The removal of a small button of bone permits the operator to see practically nothing of the brain, although it may allow escape of cerebrospinal fluid, and thereby relieve pressure. The same result may be obtained by lumbar puncture, but cases of brain tumor with fatal termination after lumbar puncture are on record, and the operation is attended with a certain amount of danger. The explanation for this is not very clear, but it seems as though the withdrawal of fluid from below causes the brain to be drawn toward the foramen magnum, and pressure thereby to be exerted on vital parts. The mere opening of the skull is not a very serious operation, and the relief afforded thereby may be great, but it should not be done until the symptoms are severe enough to justify the operation, as the hernia that frequently results may cause grave symptoms.

Walton and Paul have studied the operability of brain tumors, and from the reports of 424 cases they find that 30.7 per cent. were operable; 338, or 80 per cent., were inoperable; and 56, 13 per cent., were placed in the doubtful class.* These figures have great value because they are based upon an examination of the specimens or autopsy records of the cases. Eliminating the cases in which metastasis or infection was present elsewhere, and the cases in which it was stated that no diagnostic symptoms were present, the number of operable cases was reduced to 14, or 3.3 per cent.; the doubtful to 34, 8 per cent. The analysis shows that the highest proportion of operable cases noted in previous statistics (17 per cent., Dana) may be approximated in Walton and Paul's cases by including the doubtful or possibly operable among the operable, and that, on the other hand, the lowest estimate (3 per cent., Seidel) may be approximated by including only the undoubtedly operable and excluding those without distinctive symptoms and those with infection elsewhere.

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* Walton and Paul: "Journal of Nervous and Mental Disease," August, 1905.

The conclusions that the author has formed after the study of a large number of cases of tumor of the brain, many of them with operation, are:

Where the signs indicate that the tumor is in an accessible portion of the brain, an opening in the skull (preferably an osteoplastic flap, if this be possible) should be made large enough—three to four inches in diameter—to permit an examination of the brain. If the tumor be found it should, of course, be removed, unless it be a large infiltrating glioma incapable of complete removal. It is better to take with it a small amount of normal brain tissue than to leave any infected area. Deep probings where the tumor is not upon the surface are rarely of value and do harm. The attempt should be made to operate when the tumor is causing the earliest symptoms and therefore is small.

When the tumor cannot be removed, decompression is of benefit in relieving intracranial pressure.

Tumors of the cerebellum are usually difficult to reach, and the operation is attended with much more danger than are those upon tumors of the upper part of the cerebrum. Before any attempt is made to remove a cerebellar tumor, the relatives of the patient should have the dangers fairly presented to them. The choice is between an almost positively and possibly suddenly fatal termination, on the one hand, if the cerebellar tumor be not removed, although the patient may live many months, and, on the other hand, a chance for recovery. Where headache is severe and choked disks are developing rapidly, a palliative operation in removal of a piece of bone from the occipital fossa with opening of the dura may give relief and should be done. Where the tumor cannot be localized, decompression in the subtemporal region should be considered.

DISEASES OF CERTAIN OF THE CRANIAL NERVES

TRIGEMINAL NERVE

Tic Douloureux.—Surgical treatment of this condition gives the most satisfactory results, but it is attended with much danger when the intracranial part of the nerve is attacked, and should be resorted to only when all other means of treatment have failed. Tic douloureux is sometimes a sign of some systemic disorder, and may occur in anemic or neurotic individuals. Attention to the general health is of great importance in the treatment. Iron, arsenic, and strychnin or nux vomica may be employed as tonics. In some cases the attacks will become less severe and less frequent as the general physical condition improves. Syphilis may cause tic douloureux, producing a periostitis about one or more branches of the fifth nerve at its exit from the cranium, or a basal meningitis, and the latter is the more common; or it may cause arterial disease and thereby impair the nutrition of the nerve. Obstinate headache in an old syphilitic may escape detection as tic douloureux, but yield promptly to local and internal treatment when the true character of the pain is recognized. Where syphilis is the cause, mercury and an iodid should be employed in the manner recommended in the treatment of cerebral lues. In some cases antisyphilitic treatment will not relieve the pain, and amelioration occasionally may be obtained, even where syphilis is evident, by the local application of mesotan, in a 25 per cent. mixture with olive oil, over the painful nerve, and with salicylates or aspirin given internally in doses of ten grains three or four times daily. When tic douloureux is caused by syphilis, it is usually associated with other signs of cerebral disease, as in a case in which a severe painful tic of the face was followed by signs of a lesion in the motor cortex, and a gumma was removed from this region by operation. Where headache is persistent, the possibility of tic douloureux should be borne in mind, and pain obtained by slight pressure over the supraorbital or infraorbital foramen may lead to a correct diagnosis. The pain of a true tic occurs in sudden severe attacks, but trigeminal neuritis may cause more or less constant pain.

Disease of the mouth and of its communicating sinuses or of the ear may be the cause of severe pain in the face. A collection of pus in the antrum of Highmore may cause the symptoms of typical tic douloureux, and suspicion of the cause of the pain may be aroused when the patient complains of a disagreeable nasal discharge. All sources of local irritation about the head should be carefully investigated. Disease of the frontal, ethmoid, or sphenoid sinuses, decayed or impacted teeth, eye-strain, should receive attention. While a decayed tooth may be the cause, more frequently the pain is ascribed without reason to this condition, and one tooth after another may be extracted without relief. The *x*-ray examination may be of service.

Supraorbital pain may occur with disease of the sphenoid sinuses, and probably the former is caused by the latter. J. O. Roe reports two cases of painful tic from sphenoid disease. In one case, immediately after the opening of the sinus and removal of a myxomatous growth from the sinus, the paroxysms of pain disappeared. Later they returned, but removal of the scar tissue from the inside of the cheek where the trifacial nerve had been resected again caused cessation of pain. It is therefore of much importance in every case of tic douloureux to make a careful examination of the antrum, ethmoid and sphenoid sinuses, as a number of cases of tic have been reported from disease of these sinuses.*

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* J. O. Roe: "Medical Review of Reviews," May 25, 1905, p. 419.

Stengel has found, in three cases of acetanilid poisoning where the drug was used for trifacial neuralgia, that the neuralgic symptoms were readily controlled after the acetanilid was withdrawn and tonic treatment was employed; viz., iron, arsenic, and cardiac stimulants. He believes that the continued use of the drug so lowers the patient's resistance that instead of having a normal controlling effect on the neuralgic manifestations, it acts as a general depressant, and that the neuralgic symptoms occur with even more frequency while it is being used than would otherwise be the case.*

Severe and persistent pain in the face may be caused by tumor of the Gasserian ganglion; operation alone will give relief in such cases. If possible, the tumor should be removed, but if this cannot be done, resection of the sensory root of the fifth nerve on the side of the tumor should be performed.

Tic douloureux may be a part of multiple neuritis. The author can recall a case under his care. A man who had been in the habit of taking stout daily gradually became ataxic and weak in his lower limbs and complained of much headache. A thorough examination revealed some tenderness on slight pressure over the exit points of the trigeminal nerves and over the nerves of the limbs. After he was confined to bed and the case was treated as one of multiple neuritis, the headache disappeared.

The headache of brain tumor may be a sign of irritation of the intradural branches of the trigeminal nerve, and when the tumor cannot be removed division of the sensory root may be performed, in the hope of stopping the pain. This palliative treatment has been suggested by C. K. Mills, and as yet has not been fairly tested.

Where there is suspicion of malaria, quinin in divided doses of twenty grains daily for one or two days may give much relief, especially in the supraorbital form of pain. Some neurologists believe that supraorbital neuralgia is of malarial origin, but the evidence of this usually is found in the results obtained by the administration of quinin, and to some extent in the periodicity of the pain, but not in the presence of the plasmodium in the blood. The improvement under the administration of quinin is no more proof that the disease is malarial in origin than is the improvement under iodid proof of the presence of syphilis.

The coal-tar products may have to be resorted to for temporary relief of pain, but they are not curative. Acetanilid, phenacetin, antipyrin, may be employed in doses of three to five or ten grains, and are more efficacious when given in one dose than in divided doses, according to Gowers. They are advantageously combined with a grain of citrate of caffein and a grain of the monobromate of camphor in the well-known migraine tablet. Gowers believes that acetanilid is the most effective of the coal-tar preparations in ten-grain doses, and no more dangerous than the others. Aspirin in ten-grain doses three or four times daily, or ten to fifteen grains of the salicylate of sodium three or four times daily, with an application of mesotan, one part with olive oil three parts rubbed into the painful area once daily give relief in some cases. Morphin should be employed only when the pain is intense, as there is great danger of contracting the morphin habit in tic douloureux.

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* Stengel: "Journal of the American Medical Association," July 22, 1905, p. 243.

Dana has recommended increasing doses of strychnin, beginning with gr. $\frac{1}{40}$ three times daily and increasing by $\frac{1}{40}$ grain daily until the patient is taking half a grain daily or shows physiologic effect. He should be kept under strict observation while taking large doses of strychnin, as some persons present an idiosyncrasy toward this drug and show physiologic signs while the doses are still small. Sudden stiffness of the lower limbs may occur after moderate doses of strychnin. This form of treatment has been successful in many cases, although M. Allen Starr has failed to derive any benefit from it and has seen strychnin poisoning occur. He recommends aconitin given in pills or tablets, especially in the form of the French pills of Chapoteaux. Each of these contains $\frac{1}{500}$ grain. The remedy must be used sufficiently to produce constitutional results.

Starr* begins with one pill every four hours and decreases the intervals each day one-half hour, until one pill every two hours is being given, or until constitutional effects are evident, namely, tingling of the tongue and fingers, sense of general weakness and feebleness of the pulse. He thinks it is well to combine with this $\frac{1}{50}$ grain of strychnin during the first few days, and then $\frac{1}{100}$ grain of strychnin, when the aconitin is being given every two hours. If the strychnin does not agree with the patient or produces twitchings, the doses may be reduced, or caffein two grains, or spartein $\frac{1}{50}$ grain, may be given in its place. Some heart stimulant should be used with the aconitin when the larger doses are given, and the patient should be warned against making any sudden muscular efforts, and during the week or ten days of such treatment should walk very little.

Some persons who suffer from tic douloureux experience more pain at the seashore or in windy climates.

Trigemin is a preparation highly recommended by some German writers, but as yet it has not come into general use in this country.

The positive pole (anode) of a galvanic battery may be placed over the painful point on the face, and the negative pole (cathode) at the back of the neck. An uninterrupted current of about three milliampères may be employed for about five minutes daily or longer. The faradic brush or rapidly interrupted faradic current may also be employed. Gowers has recommended certain methods for the treatment of tabetic pains that are equally suitable for the pain of tic douloureux. Chloroform sprinkled on lint and covered with oiled silk may be applied to the head, or cocain, gr. $\frac{1}{4}$ to $\frac{1}{3}$, may be injected into the painful area, although hypodermatic injections into the face are, as a rule, to be avoided. The positive pole of a galvanic battery may be saturated by a 6 or 10 per cent. solution of cocain and placed over the painful area, while the negative pole is placed at the back of the neck or some other indifferent part. In this way the cocain is carried through the skin to the painful nerves (cataphoresis). One or 2 c.c., or a little more, of 80 per cent. alcohol, with or without a little cocain, injected near the exit points of the second and third divisions of the nerve from the skull, is a treatment much employed and often with great relief, although, unfortunately, the relief is usually temporary. Patients frequently will submit to repeated injections. C. L. Leonard* believes he has cured the pain of tic douloureux by the application of the Röntgen rays.

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* Starr: "Organic Nervous Diseases."

Osmic acid in a 2 per cent. aqueous solution (7 to 15 minims) has been injected in and about the nerve, in this country especially by John B. Murphy, and in some cases has given relief. The hypodermatic needle should be placed in different parts of the exposed nerve.

Paralysis of the Trigeminal Nerve.—The paralysis of the fifth nerve is of rather rare occurrence, and does not usually result from exposure to draft, as does facial palsy. Syphilis, in the form of basal meningitis, periostitis, or gumma, fracture of the cranium, wounds, tumors, lesions in the pons (hemorrhage, softening, sclerosis, etc.) may be causes. Fifth nerve paralysis may be a part of progressive bulbar palsy or tabes. Neuroparalytic keratitis or zoster of the face is not likely to occur unless irritative symptoms (pain) are present, and then not in every case. A lesion of the Gasserian ganglion seems more likely to cause it than one of the peripheral portions of the nerves. Hemiatrophy of the face has been found in association with disease of the fifth nerve.

The treatment of trigeminal palsy consists in finding, and if possible in removing, the underlying cause.

Facial Palsy.—The treatment of facial palsy is usually attended by very gratifying results. It is not improbable that in most cases recovery would occur if nothing were done for the paralysis, but we can hasten the process of repair by certain measures. The paralysis resulting from otitis media is more likely to be persistent than the more common form caused by exposure to drafts. A blister behind the ear of the affected side acts as a counterirritant and may be applied in the early stages of the paralysis, and the application may be repeated. The salicylate of sodium is of advantage in diseases of the nerves even where a distinct rheumatic taint cannot be determined, and may be administered in doses of ten or fifteen grains three or four times daily in the early days of the palsy; or one of the iodids (sodium, strontium, or potassium) may be substituted for the salicylates. Later strychnin may be employed, at first in doses of $\frac{1}{60}$ grain three or four times daily, soon increasing this to $\frac{1}{40}$ grain.

The application of electricity within the first week of the paralysis probably accomplishes no good, and in the opinion of some electrotherapeutists may do harm by exciting an inflamed nerve.

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* Leonard: "American Medicine," July 8, 1905.

We are not, however, perfectly convinced that the process occurring in facial paralysis is one of inflammation. After a period of ten days or two weeks the electric current may be employed with advantage. The reaction of degeneration may frequently first become manifest after about ten days from the commencement of the paralysis. The author has observed marked palsy of the facial nerve to disappear within a week, but unfortunately this is not the usual course of the disorder. If the paralysis be slight and the response to the faradic current be prompt, this current may be employed, but often no response to the faradic current can be obtained at first; the galvanic current must then be used and, indeed, in most cases the latter will be found to be the more suitable means of applying electricity in the early stage. A large positive electrode may be employed over a part of the body where a bundle of nerves is not near the surface, and the back of the neck or the chest is usually chosen. The former place is especially favorable, as the electrode can be placed here without causing the patient to disrobe, and it can be hooked over the collar and will stay in place without being held, especially if the patient presses his neck against it. This is a small but important point where the operator is unassisted, as the patient will sometimes involuntarily remove the electrode to diminish the disagreeable sensation produced by the current if he be allowed to hold the electrode. The negative pole (cathode) may be placed over the muscles or facial nerve on the affected side just below the ear, and a stable current of two to three milliampères may be allowed to pass for five to ten minutes every day or every other day. Later, I believe, the interrupted galvanic current is better than a constant, in order to produce distinct contractions of the paralyzed muscles, and an interrupted current of moderate intensity may be employed. Massage is of decided benefit in association with electricity in cases of facial paralysis. When the muscles have lost all voluntary movement, circulation in the parts, because of the muscular paralysis, is also impaired; massage mechanically increases the circulation of the parts and the tonicity of the muscles. One of the machines employed for vibratory massage may be used advantageously to stimulate the paralyzed muscles. Facial paralysis of the duration of a year or more may show decided improvement after persistent massage and galvanization.

It is difficult to trace any rheumatic element in most of the cases of facial paralysis resulting from exposure to draft, but in those cases in which it exists the salicylates, iodids, or some form of the alkalis are especially applicable.

Facial paralysis from otitis media often resists all forms of treatment, as the nerve has undergone serious degeneration within the Fallopian canal. After a reasonable time, six months to a year, if no improvement has occurred, anastomosis of the facial nerve with the hypoglossal or spinal accessory would be proper. The otitis media demands prompt treatment, as the danger of cerebral abscess is not to be ignored. Metastatic abscess of the brain in some instances may develop after the purulent process of the middle ear has lasted many years.

Facial paralysis in rare instances may be a sign of tabes. The prognosis as regards recovery is not so good as when paralysis develops after exposure to draft or cold. The paralysis of the facial, as of the ocular, nerves, occurring in this disease, often disappears without treatment, and is probably caused by alteration of the nerve-fibers rather than by primary degeneration of the facial nucleus within the pons. Secondary changes of the nucleus must occur, however, if the paralysis persist, but are not always permanent.

The patient can assist in his recovery by attempting to contract the muscles of the paralyzed side of his face while watching their movements in a looking-glass. In this way he will be better able to judge of results and to learn the proper movements. He may hasten return of power by attempting voluntary contraction while the electric current is allowed to pass. Many persons without any facial weakness experience difficulty in drawing up one corner of the mouth.

When facial palsy is persistent, a movable band of metal attached to the ear and hooked into the corner of the mouth has been proposed, but the attention it attracts is as great as the deformity it attempts to hide, and few desire it. As a means of treatment applied when the patient is not in the company of strangers it may be employed, but gives little promise of benefit.

Facial paralysis may be part of a multiple neuritis, but seldom occurs in association with disease of the nerves of the limbs. When it does, the prognosis should be guarded, and is not so good as when draft is the cause of the paralysis. It nevertheless may yield to treatment.

Facial paralysis may result from pressure. The author has seen it occur when the occipital region was operated upon for cerebellar tumor and the head was pressed to one side. Such paralysis is rare and usually of short duration. In the case to which reference is made it disappeared within two weeks without treatment. The author has also seen bilateral facial paralysis result from the use of the forceps at birth. The prognosis in these cases is usually good unless the pressure has been excessive.

Stein has seen paralysis of the facial and hypoglossal nerves on the same side occurring at birth. He believes the common causes of congenital facial palsy are pressure over the stylomastoid region from a contracted pelvis, from an exostosis, or from a too prominent symphysis cartilage.

The paralysis not infrequently is caused by syphilitic basal meningitis, and is usually in association with paralysis of one or more cranial nerves. The treatment then is that of cerebral syphilis.

The eye usually needs little attention in cases of facial paralysis. It may become inflamed from exposure to wind and dust, but trophic changes are not nearly so likely to occur as they are after removal of the Gasserian ganglion. Inflammation may be combated by washing the eye with a boric-acid solution, but this is seldom called for, much less the protection of the eyeball by a shield.

When contracture of the paralyzed facial muscle begins, electric treatment should be discontinued. It can do no good and, in the opinion of some, may do harm. Contracture occurs only when the return of voluntary power is slight, and not in cases of persistent palsy without any improvement.

Facial palsy resulting from fracture of the base of the skull is almost invariably persistent, and may be associated with other cranial nerve palsies. In these cases surgery may be employed with advantage.

When caused by pressure from an inflamed parotid gland, treatment should be directed toward allaying the glandular inflammation.

Palsy resulting from bullet or stab wounds usually demands prompt surgical treatment. If the nerve merely has been compressed or injured slightly, recovery may occur without operation; but where complete division or serious injury of the nerve has resulted, operation is needed. Where doubt is entertained regarding the intensity of the injury, it would be well to wait a few months, after which, if no improvement had occurred, nerve anastomosis should be performed. Less time may be allowed to elapse in traumatic cases than in those resulting from exposure to draft before operation is performed, as the chances are that in the former the injury is permanent.

While recurrent facial palsy is not frequently seen, it does occur sufficiently often to justify advising the patients who have had facial paralysis to avoid severe drafts. The paralysis may occur on the side that previously was not paralyzed.

SURGICAL ASPECTS OF CERTAIN LESIONS OF THE CENTRAL NERVOUS SYSTEM

By Charles H. Frazier, M.D.

TUMORS

The surgery of cerebral tumors has long since passed beyond the speculative or developmental stage, and the general practitioner should familiarize himself with present-day accomplishments of this special field and not be influenced by the traditional fears of a decade or more ago, when any operation on the brain was regarded as a hazardous undertaking. From the surgical point of view, there are two classes of tumors—the operable and the inoperable; probably one in every ten tumors is operable, and by an operable tumor is meant one which can be localized, is accessible, and well defined, not infiltrating. The inoperable tumor, on the other hand, cannot be localized, is situated in an inaccessible region, and is not sharply defined. It should be borne in mind, however, that before the operation it is often impossible to tell with which type of tumor we are dealing or whether we are dealing with a tumor at all, and not with a meningitis serosa or simple cyst.

I could cite striking examples of just such cases, where a diagnosis of tumor seemed to admit of no doubt, and the operation revealed a condition which proved much less serious and was entirely relieved. The patient should, therefore, be given the benefit of the doubt, and whenever suspicion is aroused as to the presence of a tumor, an exploratory operation should be recommended. Furthermore, it should be borne in mind that the life history of tumor extends over a number of years, and one should be on the lookout for the symptoms at an early period of its development and not wait until symptoms of intracranial tension are ushered in with headache, vomiting, and choked disk or papillo-edema, which represent the terminal stage of the disease. It is just as reasonable to wait for the signs of carcinomatous invasion of the lymph-nodes before recommending operation for a malignant growth of the breast. To wait and watch until hemiplegia, hemianesthesia, or hemianopsia is complete is as unjustifiable as the watching of the gradual destruction of a limb by sarcoma (Horsley). Thirdly, the physician, in waiting for the advanced stage of the disease, should not ease his conscience by resorting to the so-called "expectant" treatment. The latter, to quote Horsley again, is merely a ritual and not the treatment of the disease at all, and usually implies that the physician has not made a correct diagnosis. I could cite numerous examples where patients have been allowed to lose their eyesight because, under the classic administration of potassium iodid, there was a transient and delusive improvement. An exploratory operation *per se* is so devoid of risk that the burden of argument rests with the practitioner who withholds from his patient the possibilities of relief, be it temporary or permanent, which surgical therapy alone can offer.

There are two operative procedures, each with its special indication—the exploratory or radical, and the palliative or decompressive. Whenever the tumor can be localized with reasonable accuracy, the suspicious area should be uncovered through a liberal opening and the tumor, if found, removed. Should the tumor not be found, or prove to be of the inoperable variety, the osteoplastic flap should be replaced and the brain decompressed in the temporal region. However, in certain instances the tumor may lie in a silent zone and its localization may be impossible, so that one must proceed at once with the palliative or decompressive procedure. Operation of any kind may be said to be contraindicated only when there is reason to believe the terminal stage of the disease has been reached and the patient's condition would not justify resort to operation under any consideration.

To master the technic of cranial surgery requires more experience than falls to the lot of most surgeons, and success depends not only upon mastery of the mechanics of this special field, but a knowledge of the normal and pathologic anatomy of the brain, its membranes, vessels, lymphatic spaces, and ventricles. These procedures will be outlined briefly: the exploratory craniotomy for cerebral tumors, temporal decompression, and the exposure of tumors of the cerebellum.

1. **Exploratory Craniotomy.**—The anesthetic should be ether and not chloroform, and entrusted only to one of experience. The scalp may be rendered bloodless by a tourniquet of heavy rubber tubing anchored to the scalp at three points—the occipital, frontal, and one temporal region—to prevent its becoming dislodged. The incision in the scalp should be made one-half inch to the outer side of the margins of the bone flap. The latter should be large enough to uncover with liberal allowance the suspected seat of the tumor. The base of the flap should always be in the temporal region, to assure a liberal blood supply. The bone may be sectioned with a de Vilbiss forceps, the Gigli saw, or a spiral drill, in any case the initial opening or openings in the skull being made with a Hudson drill. The flap is reflected, securely wrapped in gauze to prevent the bone from being stripped of its scalp, and an incision made in the dura parallel with and one-half inch within the margins of the bony opening.

Any deviations from the normal appearance, normal consistency, or normal intracranial tension are noted. If the tumor is detected and is not infiltrating, it should be removed by following the line of cleavage between it and the normal tissue with the least possible pressure. Free hemorrhage from the cavity may be controlled by ligatures applied to the pial veins or by a tampon of gauze. The flap is replaced and the wound closed with interrupted silkworm-gut sutures.

2. **Cerebral decompression,** a much less formidable procedure, implies the relief of pressure afforded the brain by removing an area of bone from beneath the right temporal muscle, and by a crucial incision in the dura. The operation may be done under regional anesthesia, by injecting the third division of the trigeminal nerve with a 4 per cent. cocain solution. The incision begins at the junction of the hairline with the temporal region, follows the direction of the temporal ridge, and is extended down with a sweeping curve to the hairline just above the ear. The flap, composed only of the skin and cellular tissue, down to the temporal fascia is reflected forward, and a flap similar in shape but smaller in dimensions is made in the temporal fascia. The temporal muscle is split parallel with its fibers, the muscle retracted in either direction, and about two square inches of the underlying bone removed. After making a crucial incision in the dura the several layers of the scalp are closed *en tier*. A hernia of variable dimensions according to the degree of intracranial tension will establish itself at the site of the cranial opening.

3. **Suboccipital Craniectomy.**—Operations for exposure of tumors of the cerebellum are more difficult of performance. In some cases it is necessary to remove the bone from one, sometimes from both sides of the median line, depending upon the seat of the tumor. If the tumor is near the median line or in the cerebellopontile angle, a bilateral opening is preferable. Hemorrhage is controlled only by the use of hemostatic forceps and bonewax. Ether is the only safe anesthetic, and the region is best explored with the patient on his side with head bent forward. The incision may begin at the median line or at one mastoid process, and follow the direction of the superior curved line, but a half-inch above it, across to the mastoid process on the opposite side. A vertical incision extends from the midline downward a distance of three inches. The incision extends down to and includes the pericranium, and the musculo-aponeurotic flaps are reflected to either side. An initial opening is made in the skull to one side of the median line, and the bone removed from over one or both cerebellar hemispheres, uncovering the transverse sinus above, and removing the posterior rim of the foramen magnum below. If both fossæ or the median surfaces are to be explored, or if it be necessary to displace the hemispheres for exposure of the cerebellopontile angle, the inferior occipital sinus should be divided between two ligatures, the dural flap reflected, and both hemispheres uncovered. A systematic exploration for the tumor is then made. Probably eight out of ten tumors of the posterior fossa, which come to operation, if not more, will be found in the cerebellopontile angle, and to expose this region the greatest care must be exercised to avoid undue pressure upon the pons and medulla. If the angle tumor is firmly adherent to these structures, attempts at removal will frequently be disastrous. Fragmentary, incomplete excision is

to be deprecated, as recurrence is inevitable; and with recurrence the rate of growth is relatively more rapid and the expectation of life proportionately shorter. In closing the wound, the dural wound is closed only in part in order to allow for any subsequent increase of tension. The musculo-aponeurotic layer is closed with continuous catgut suture, and the skin with interrupted suture of silkworm-gut. Drainage should be introduced through a stab wound at the base of the flap.

The results of intracranial operation for new-growths vary according to the nature of the operation and the character of the growth. With pretentorial lesions an exploratory operation is almost devoid of risk, and in suitable cases the removal of the growth adds but little to the mortality. In the case of subtentorial lesions the risk of operative procedures is always greater, although here again there is little risk in an exploration, and the mortality will depend upon whether the tumor, if found, can be removed without undue trauma to the brain-stem.

Simple decompression, either in the suboccipital or the temporal region, is a very much less formidable and therefore less dangerous procedure. In the last seven years the author has lost but five cases following temporal decompression, and four of the five cases he should now regard as too far advanced to justify surgical interference of any kind. In the last twenty-two suboccipital decompressions for cerebellar lesions there were two deaths, but in both these a thorough exploration for the tumor was conducted, thus adding materially to the extent of the exposure and to the duration and gravity of the operation.

As to the expectation of life, one can never predict with any degree of accuracy what this may be. Generally speaking, patients with cerebral lesions survive a much longer period than those with lesions of the cerebellum or pons. The proximity of the important vital centers in the latter instance necessarily affects the prognosis, as in so many instances tumors of the posterior fossa originate near the pons or medulla, and soon, either directly or indirectly, disturb their junction. Then, again, the duration of the illness prior to the operation is an influential factor: the longer the duration, the larger the tumor, and the more rapid its growth, the shorter the period of survival. Of my earlier pretentorial cases, there are two alive three years, and two four years, after the operation. One patient operated upon in 1903, with symptoms of cerebral tumor, is still alive. In one of the four-year survivals the operation revealed a large and vascular tumor. In the subtentorial cases the prolongation of life is on the average shorter, although in three cases the patients have survived the operation seven, six, and four years respectively.

As to the influence of decompression upon headache and vomiting, one or the other or both are relieved in about two of every three cases, and in subtentorial lesions the vertigo is almost invariably relieved, at least to some extent. With respect to vision, it should be borne in mind that in patients afflicted with papillo-edema ultimate blindness is always sure to result unless the brain is decompressed, and when this measure is adopted in any but the advanced stage, the prognosis as to sight is favorable. That the gravity and inevitable tendencies of papillo-edema are still not appreciated by the practitioner may be illustrated by my own experience. In one out of every three cases, if the optic nerve was not atrophied, the papillo-edema at the time the patient was brought to operation was so far advanced that restoration of vision was out of the question.

HEMORRHAGE

Surgical intervention may be required in the following: Extradural hemorrhage, intradural hemorrhage, both of traumatic origin, intracranial hemorrhage in the newborn, and external hemorrhagic pachymeningitis.

Extradural Hemorrhage.—In the majority of instances extradural hemorrhage is due to rupture of the middle meningeal artery; occasionally, however, to the rupture of a sinus or an emissary vein. For anatomic reasons the anterior branch of the middle meningeal is more frequently injured than the posterior branch. The treatment is always operative, and the sooner the operation is performed, the better; or, as Jacobson puts it, "trephine; and trephine early." There are certain cases in which localization may be impossible, where there may be some uncertainty as to whether there is any hemorrhage at all, or, if so, on which side. A coexisting cerebral contusion may so mask the symptoms as to make a differential diagnosis and localization sometimes impossible. In opening the skull for exploration, the conical trephine or, preferably, the Hudson drill may be used rather than the osteoplastic flap. If hemorrhage from the anterior branch of the middle meningeal is suspected, the initial opening should be made 3 or 4 cm. behind the external angular process of the frontal bone, and 4 cm. above the zygoma; if from the posterior branch, at the intersection of a horizontal line passing over the external angular process, with a perpendicular line passing through the internal border of the mastoid process. In the former case a clot would be found at the lower and internal portion of the parietal bone, and in the latter, at its postero-inferior portion. The original opening must be enlarged sufficiently to allow a thorough exploration and the removal of the clot. If an extradural clot has not been found, the operator proceeds to open the dura, especially if the latter bulges prominently, has a bluish discoloration, and when there is no pulsation. Failing to find any cause for the symptoms of cerebral compression on the side first explored, one should remember the occurrence, though rare, of a homolateral hemiplegia. Therefore, if the symptoms persist, exploration should be made on the opposite side. The clot when found should be removed and hemorrhage controlled, preferably by ligation of the ruptured branch or by the use of a tampon, and as a last resort by ligation of the external carotid artery. Before the wound is closed, a rubber tube of small caliber should be introduced as a safeguard against consecutive oozing or secondary hemorrhage.

Intradural Hemorrhage.—The source of intradural hemorrhage may be either an injury to the middle meningeal artery, to an intracranial sinus, especially the longitudinal, or to the pial veins. In most instances the hemorrhage, which follows laceration of the pial vessels, is associated with a more or less serious contusion of the brain substance. Intradural hemorrhage is more variable in extent and in location than extradural hemorrhage. There may be either small punctate hemorrhages, more or less widely distributed over the cortex, a thin sheet of blood in the meshes between the pia and arachnoid membranes, or a larger hemorrhage between the dura and the arachnoid. When accompanied by serious cerebral contusion, the symptoms of the latter may altogether mask, in the early stages, at least, the signs of hemorrhage, as in a case seen by the author where the complete relaxation or flaccidity masked the symptoms of local compression, which became quite evident after the general relaxation had disappeared.

Intradural hemorrhage is a very much more serious condition than extradural hemorrhage, partly because of the proximity of the clot to the cortex, partly because of the associated cerebral contusion. In most instances it is the latter condition which gives to the case its more grave aspects. While the clot may be more readily absorbed in the intradural than the extradural space, the dangers of delay in removing the intradural clot are greater because of the ill effects of the continued pressure on the cortex and of the tendency to such serious sequels as epilepsy and traumatic neurosis. If the blood-clot is not removed, adhesions may form between the membranes, the clot may become organized into a thin sheet of connective tissue, or in the rôle of a foreign body lead to the formation of the so-called hemorrhagic or arachnoid cyst.

Because of the serious sequels, surgical intervention is imperative, even though the extent and character of the hemorrhage may present many difficulties. An attempt, however, should be made in all cases to uncover the site of the hemorrhage and to remove the clot. The presence or recurrence of hemorrhage should be guarded against by careful search of the source of hemorrhage, in most instances the pial veins, and its control by ligation.

Intracranial Hemorrhage in the Newborn.—Intracranial hemorrhage in the newborn is a more common occurrence than would be indicated by the immediate consequences. In an analysis of 74 autopsies upon infants, McCrae and Klatz* found intra- and extradural hemorrhage in 37, and in many of these hemorrhage was the direct cause of death. Of the surviving cases, infantile hemiplegia, imbecility, and epilepsy, separately or in combination, are almost inevitable consequences. It is generally conceded that intracranial hemorrhage is more apt to be a complication with primiparæ in difficult and prolonged labors, with or without the use of forceps. In a series of 23 cases tabulated by Seitz,* at least one-quarter were uncomplicated spontaneous deliveries. The actual source of hemorrhage, however, is one or more of the cerebral veins, which, as they pass from the cortex to the lateral lacunæ of the longitudinal sinus, are ruptured by the overlapping of the parietal bones. The clot is nearly always intradural, usually on the convexity of the hemispheres, over the central convolutions, and near the mesial line, but if the dura is torn, the clot may extend into the epidural space. Hemorrhage seldom occurs into the ventricles, and almost never in the brain substance. It is frequently bilateral and may be pre- or subtentorial.

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* Quoted in Archibald's "Surgery of the Head," p. 209.

The diagnosis of hemorrhage would be suggested by the following facts: A difficult and protracted labor, signs of asphyxia at birth, bulging of the anterior fontanel, subconjunctival and palpebral hemorrhages, edema of the eyelids, and proptosis; convulsions, general or unilateral, accompanied by persistent rigidity of the limbs and inversion of the thumbs, and paralysis of one or all the extremities. It is important to determine, if possible, whether the hemorrhage is pre- or subtentorial. In subtentorial hemorrhages the children are frequently born more or less asphyxiated, but they cry lustily and often give the impression at first of being perfectly healthy children, not infrequently taking the breast. In contradistinction to cases of pretentorial hemorrhage, they are at first comparatively quiet, but after the course of several hours one sees signs of medullary disturbance: an irregular, weak respiration, followed occasionally by pronounced convulsive seizures with deep cyanosis. The skin meanwhile becomes bluish-yellow, and the fontanels extremely tense; the picture suggests atelectasis of the lungs; the respiratory disturbance becomes more aggravated, and inside of twenty-four to forty-eight hours the patient dies. If the patient should survive this period, focal symptoms may develop from pressure on the cerebral hemispheres, or signs of spinal irritation, when the blood descends into the spinal canal.

In pretentorial hemorrhage the conditions are very different and the picture varies accordingly. Here the lesion is usually unilateral; no blood-staining fluid will be recovered on lumbar puncture, and in bulk the hemorrhage is very much larger, resulting from rupture of the veins emptying into the longitudinal sinus. The first day after the child is born nothing unusual may be observed; on the second day there are signs of extreme restlessness, but what is of still greater diagnostic importance, the child cries and screams almost ceaselessly and for no apparent reason. This inexplicable screaming is pathognomonic, and due probably to tension of the dura. Gradually signs of increasing intracranial tension appear: respiratory disturbances, loss of consciousness, elevation of blood-pressure, occasionally slowing of the pulse, together with symptoms of local compression, as contralateral paralysis. If unrelieved, the intracranial tension will gradually increase, partly as a result of the cerebral edema, and the child dies between the fourth and the eighth days from respiratory failure.

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* "Münch. klin. Woch.," March 24, 1908.

The morbidity of intracranial hemorrhage in the newborn is high. Of the 23 cases collected by Seitz, only five recovered. In every case in which the diagnosis can be established an operation should be performed as a life-saving procedure. No doubt the mortality will be reduced by constant resort to operation, simply by relieving intracranial tension. The very wide distribution of the hemorrhage, the extreme sensitiveness and the delicacy of the cortex at the tender age of the patient, the difficulty of removing all the blood-clot when it is entangled in the meshes of the pia and arachnoid membranes cannot but make one skeptical as to the effect the operation may have as a prophylactic measure against the unfortunate and distressing sequels. It is the latter, after all, which give to this lesion its more serious aspects. While the lives of a few cases have been saved by operation, there is no evidence at hand to determine whether the operation will prevent the subsequent development of these nervous complications. The technic of the operation requires no special comment; the skull of the infant is so thin that the cortex can be easily and quickly uncovered. The subdural space must be explored in all cases, especially in the region of the central convolution. If, however, the symptoms point to a subtentorial lesion, operation is more imperative, as a blood-clot in this locality is almost inevitably fatal. It may be said, in conclusion, that at the present time the operative treatment of intracranial hemorrhage of the newborn is *sub judice*. The pathogenesis and symptom complex are thoroughly understood; the diagnosis is not difficult, and operation may save life by relieving intracranial tension. As a prophylactic against epilepsy, imbecility, or hemiplegia, surgical interference has as yet little to substantiate any claim.

External Hemorrhagic Pachymeningitis.—As has already been pointed out by Spiller (page 723), the blood-clot is only one of the serious factors in the pathology of this condition, and its removal cannot cure the fundamental disease or the tendency to formation of new blood-vessels and repeated hemorrhage. In view of the fact that the operation has been resorted to, with favorable results in a few instances, whenever the symptoms of intracranial pressure are pronounced and the diagnosis established, an attempt should be made to expose and remove the blood-clot, even though, as in some cases, both sides of the brain may be involved.

ABSCESS OF THE BRAIN

The etiology, diagnosis, and symptoms of cerebral abscess have already been discussed in by Spiller (page 747). The practitioner and surgeon should remember that at least 50 per cent. of brain abscesses follow chronic otitis media, and that in the absence of any history of disease of the auditory canal and communicating structures a careful inquiry should be made in the previous history whether the patient has an infectious fever, such as typhoid fever or influenza, an infection of the cellular tissues of the scalp or face, a compound fracture, or a penetrating wound of the skull. Because abscesses frequently develop slowly, and because there may be no serious constitutional or striking focal signs for weeks after the infection was implanted in the brain tissue, the character of the lesion and the causal relation of the exciting factor are frequently not suspected.

It was Sir William Macewen who said that an uncomplicated cerebral abscess, when its position is clearly localized and surgical measures adopted for its relief at a sufficiently early period, is one of the most hopeful of all cerebral affections. Yet for various reasons the mortality following operation is high. Kocher reported 92 cases with 51 recoveries; Oppenheim 196 with 96 recoveries; Röpke 148 with 59 recoveries.* The high mortality must be attributed—(1) To the difficulty in localizing the abscess; (2) to the often unnecessary postponement of operation; (3) to difficulty in protecting the adjacent healthy brain tissue and membranes from contamination; (4) to inexperience on the part of the operator; and (5) to inadequate drainage. Many, if not most, of the cases of brain abscess are operated upon, because of the frequency of otitis media as a cause, by the ear specialist, who may have had neither the experience nor the equipment necessary for the orderly and successful performance of an intracranial operation. The surgeon's ingenuity and judgment are taxed much more in the management of cerebral abscess than of cerebral tumor, and yet the aurist never includes the latter lesion in his field of activity.

Ballance has called attention to certain features of the pathology of abscess which have a direct bearing on the treatment. In most cases of slowly spreading infection from chronic disease adhesions occur at the site of infection, binding together dura, arachnoid, pia, and cortex. The lymphatic sheaths of the numerous small blood-vessels which traverse the cortex at right angles to its surface are in direct communication with the subarachnoid space, and through these, as through a number of capillary tubes, infective matter easily traverses the cortex and reaches the white substance within. The cortex is very vascular, and its connective-tissue element, reinforced by numerous prolongations from the pia mater, is abundantly supplied with connective-tissue corpuscles. Hence, it is able to offer a strenuous resistance to the bacterial attack, and does not ordinarily undergo any extensive destruction. Where it is traversed by the infective material, a barrier of fibrous tissue is thrown out, limiting the destructive process to the formation of a narrow track. The white substance is much less resistant, and it would seem that the greater the distance from the cortex, the more easily does bacterial action cause dissolution of brain substance. Thus the abscess comes to assume a mushroom-like shape, with the narrow portion or stalk attached to the dura at the original site of infection. Its lumen presents a ready-made channel with fibrous walls through which drainage can be effected and the infective material made to leave the brain. This natural tube with its fibrous walls is not liable to be obstructed as a drainage tract through normal brain substance. If, then, the abscess can be tapped through the stalk itself without passing the knife through healthy cortex and meninges, there would be efficient drainage without risk of suppurative meningitis or of hernia cerebri.

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* Quoted by Starr, "Medical Record," March, 1906.

When symptoms of abscess develop in the presence of inflammation of the middle ear or mastoid region, the operator should proceed first to attack these structures and then remove the source of infection. In some instances the symptoms which lead one to suspect abscess may have been due only to an inflammation of the cerebral membranes, and after the source of infection is removed the symptoms may subside. If, on the contrary, the symptoms persist, or should we be dealing with a case in which there are no signs of acute inflammation of the middle ear or mastoid, the surgeon should proceed at once to explore for the abscess, the method of approach depending upon whether the abscess is believed to be in the temporosphenoid lobe or in the cerebellum. In doubtful cases, the temporosphenoid lobe should be explored first, as abscess is found in this position in the proportion of two to one. The skull is opened an inch above the posterior root of the zygoma, and the opening enlarged sufficiently to admit of thorough exploration. The dura is then opened and a careful inspection made for adhesions which would indicate the path of infection. If the dura is dark and inflamed, if there are adhesions between the membranes, if the brain bulges as though under tension, there should be little doubt as to the presence of an abscess.

To find it I prefer to use a blunt canula armed with an obturator. The latter prevents the canula from being blocked with brain tissue. The canula is introduced through the site of the stalk, if this can be recognized, if necessary in several directions. If the presence of pus is detected, the margins of the opening in the skull should be carefully walled off to prevent contamination of the meningeal space, and the tract leading to the abscess cavity dilated sufficiently to admit of the introduction of a drainage-tube of large caliber with unyielding walls. Should the pus not escape freely, it may be necessary to enlarge the opening and introduce a drainage-tube of larger caliber. The practice of introducing two tubes and syringing the cavity does not commend itself to the author. Owing to the fact that the pus is thick and often contains sloughs and softened brain tissue, free drainage can be secured only by using tubes of large caliber. The tendency in some cases for the tube to be forced out of the cavity by the swollen and edematous brain should be guarded against by suturing the tube to the margins of the wound. Should the drainage be interrupted and signs of pressure recur, a secondary exploration will be necessary.

To explore for cerebellar abscess the skull should be opened along the probable course of infection; that is, through the mastoid rather than the suboccipital region. After enlarging the opening and walling off with protective pledgets of gauze, the surgeon proceeds as in the manner prescribed for temporosphenoid abscess.

When dealing with abscesses secondary to frontal sinus disease or to any other source, the same plan and general principles should be observed. An opening adequate for thorough exploration should always be made, the meningeal space protected, thorough evacuation and drainage provided for, irrigation avoided, and the drainage-tube anchored to the wound.

The prognosis is always grave; not more than 50 per cent. recover, and this, I believe, is a liberal estimate. Secondary meningitis, delay in operation, multiple abscesses, dumb-bell-shaped abscesses, inability to find the abscess or to maintain drainage, are some of the factors to which must be attributed the high rate of mortality.

MENINGITIS

The various types to which surgical therapy has been applied include the diffuse suppurative, the tuberculous, and the posterior basal meningitis of infants.

Suppurative Meningitis.—There are many difficulties with which the surgeon has to contend and to which must be attributed in large measure the discouraging results.

Foremost is that of securing adequate and continuous drainage. The repeated formation of adhesions at the site of the drainage opening, and the tendency, as the intracranial pressure increases, for the brain to protrude through the opening, are serious obstacles to drainage, as is also the accumulation of the exudate in the meshes of the arachnoid. As a rule, there is little exudate in the subdural spaces where drainage would be most feasible.

Suppurative meningitis may be diffuse or localized, and in the latter instance it is frequently a disease of the middle ear. The indications for operative intervention are clear and well defined. After removal of the diseased focus the intradural space should be opened, the exudate evacuated, and adequate drainage provided for.

The outlook in cases of diffuse suppurative meningitis is always grave, with or without surgical intervention. A few cases are on record in which an operation seemed to save the patient's life; notably among these is the case, so frequently quoted,* one of diffuse meningitis secondary to basal fracture, in which, after lumbar puncture and direct drainage through bilateral openings in the parietal bones, the patient recovered. Von Bergmann believed that the cases which recovered after drainage operations were due to the staphylococcus pyogenes albus infection, not the aureus, and that these would have recovered as promptly with lumbar or ventricular puncture. Whether the operation of Kümmell relieved the patient by evacuation of the exudate or by relief of intracranial pressure is a matter which admits of discussion.

Tuberculous Meningitis.—While the course of tuberculous meningitis is not so rapid, as a rule, as that of suppurative meningitis, the same difficulties are encountered in the attempt at relief by surgical intervention. The impossibility of either reaching or removing the exudate, the interruption of drainage by the formation of adhesions or intracranial pressure, is quite as disturbing a factor in the tuberculous as in the suppurative type. It may be borne in mind, however, that excessive pressure upon the medullary centers is quite as serious a factor as the infection itself. There is at least one indication, therefore, in the treatment of this disease, namely, the relief of intracranial pressure, so that in all cases lumbar puncture should be resorted to. Should the aqueduct of Sylvius be occluded, ventricular puncture or temporal decompression on one or both sides may be resorted to. It is extremely doubtful, however, whether these latter more radical procedures will exert any more favorable influence than simple lumbar puncture.

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* Kümmell, "Arch. f. klin. Chir.," vol. lxxvii, part 4.

Posterior Basal Meningitis of Infants.—Inasmuch as in many instances the symptoms are due to the secondary hydrocephalus rather than to the meningitis, the treatment should be directed to the relief of pressure and to drainage of the ventricles. The principles applied to the treatment of acquired hydrocephalus are applicable here. (See Operative Treatment of Hydrocephalus.)

EPILEPSY

Epileptic subjects are frequently subjected to operative intervention. The otherwise hopeless nature of the disease tempts physicians and family to urge and surgeons to operate more frequently than the end results justify. Because of the well-known effect of operation *per se* upon the epileptic subject, and because of the scarcity of reliable statistics, it is difficult to express with any degree of accuracy the end results of surgical therapy. In justification to the patient and to surgical procedures, the greatest care should be exercised in the selection of cases.

In the selection of cases for operation, it should be borne in mind that the more predominant the *motor* disturbance, the more likely is the case to be favorably influenced, and the more conspicuous the psychic manifestations, the graver the prognosis. For the present, we should regard idiopathic epilepsy as presenting no surgical indications despite the fact that a few cases have been recorded as greatly improved, following the establishment of a large opening in the right frontotemporal region of the skull. This operation was suggested by Kocher on the ground that the epileptic attack is due to an increase in intracranial tension, especially of the cerebrospinal fluid, but as a matter of fact it is more than likely that the change in tension is not the cause but the effect of the attack. The end results of the procedure by no means justify its indorsement. In addition to idiopathic epilepsy we should regard as a contraindication epilepsy of any variety when the attacks are of many years' duration and frequently repeated. When the epileptic habit so called is well established, surgical intervention will not only not relieve, but may aggravate the condition. Operation should be regarded as unjustifiable when epilepsy is associated with idiocy, imbecility, or insanity.

There are two types of epilepsy for the relief of which surgery offers a measure of hope—the reflex and the Jacksonian. There is, no doubt, a causal connection between the adherent prepuce, the painful scar, and the cutting teeth. The scar should be excised, the prepuce removed, and the teeth lanced. The relief is often immediate, and the results frequently enduring. Of the Jacksonian type, we may recognize two classes: one an earlier, the other a later, stage of the disease. In the first, the convulsive seizures are confined to one side of the face, to one arm or to one leg, to one, two, or all three, beginning, however, *constantly* in the muscles which receive their central innervation from the corresponding center for face, arm, or leg. In this variety particularly, representing as it does the earlier stage of Jacksonian epilepsy, do we look for the better end results. On the other hand, when the attacks, though focal at their onset, become eventually general, involving both sides of the body, and when with each attack consciousness is lost, the removal of a focal lesion, even if one be found, is not likely to break the epileptic habit.

The fundamental difficulty in the surgical treatment of Jacksonian epilepsy is not, as commonly believed, the failure to find a demonstrable lesion, but the failure to find a lesion amenable to surgical treatment. Adhesions, if removed, will often reform; sclerosis of the cortex, porencephalic cysts, hemorrhagic encephalitis, chronic pachymeningitis, are lesions frequently uncovered at the operating table, but the surgical treatment which would influence any one of these has not yet been discovered. For those cases of traumatic epilepsy in which no macroscopic lesion could be found Horsley recommended excision of the cortical center. By this method a small percentage of cases have been recorded as cured or improved after the three-year limit.

It has been my own practice in the management of epileptic cases to select cases for operation on the principles already laid down. Operation is practised only in those with Jacksonian attacks. The motor area is freely exposed by reflecting a large osteoplastic flap, and the source of irritation is searched for. If a thickened and adherent dura is found, that portion of the dura overlying the motor cortex is removed; the offending lesion may be a spicule of bone or foreign body and is readily removed. In the absence of any such demonstrable cause either the cortical center is excised or the brain is decompressed in the temporal region.

Prophylaxis.—The importance of prophylaxis should be lost sight of no more in epilepsy than in cancer. The ounce of prevention and the pound of cure need no revision when applied to epilepsy. Exploratory operations after serious cranial trauma and the removal of blood-clots, the repair of cranial defects the result of injury or disease, the removal of the clot in the intracranial hemorrhage of the newborn —all these are measures which, put into practice, will reduce to some extent the incidence of epilepsy.

HYDROCEPHALUS

The surgical treatment of hydrocephalus may be said to be in the experimental stage. A number of methods have been devised for draining the ventricles or the subdural space, but in none have the results been such as to offer much if any encouragement. The mortality is high, and there are but few cases on record that may be said to have completely recovered. The plan of procedure should depend upon whether the hydrocephalus is congenital or acquired, whether the communication between the ventricle and subdural space has been shut off by tumors or inflammatory processes. As an evidence of the unsettled state it is necessary only to enumerate the various procedures which have been tried. The ventricles have been drained directly into the subdural space, into the cellular tissues of the scalp, and into the subaponeurotic space; into the cellular tissues in the lumbar region; into the retroperitoneal space or abdominal cavity; into the longitudinal sinus; into the jugular vein, and even into the pleural cavity. Repeated lumbar puncture has been practised, as well as of the ventricles and corpus callosum. If an obstruction at the foramen of Monro or at the aqueduct of Sylvius has shut off the communication between the ventricles and subdural space, one of the several methods of direct drainage of the ventricles must be adopted.

Of the methods above enumerated, preference should be given to drainage of the ventricles with a pure platinum tube pointed at right angles, one limb of the tube puncturing the ventricle, the other lying between the brain and the dura. This establishes a permanent communication between these spaces and is the least complicated of any of the methods designed to secure permanent drainage. Ligation of both common carotid arteries at intervals of ten days or two weeks has been recommended upon the ground that, by diminishing the flow of blood to the brain, the secretion of cerebrospinal fluid will be materially diminished. This method I have practised in one instance with gratifying results.

When hydrocephalus is associated with such symptoms of intracranial tension as headache, vomiting, and choked disk, relief may be afforded by temporal decompression. As in some cases permanent results have been obtained by repeated ventricular or lumbar puncture, either of these methods should be tried before resorting to more formidable procedures. In tapping the ventricles, the method of Keen may be used. A point is chosen 1¼ inches above the upper margin of the external auditory meatus, and an equal distance behind the meatus. At this point on the skull a small button of bone is removed with a trephine and a canula introduced at a depth of 2 inches in the direction of a point on the opposite side of the head, 2½ inches to 3 inches above the auditory meatus.

TRIGEMINAL NEURALGIA

Trigeminal neuralgia is in a great many instances a surgical affection, at least it should always be so regarded just as soon as the so-called constitutional measures and the use of certain drugs prove inefficacious.

Leaving out of consideration those cases which respond to constitutional and drug therapeutics, trigeminal neuralgia may be treated by one of the following methods: (1) Alcoholic injections into the peripheral nerves, or into the second and third divisions at their point of exit from the base of the skull. (2) Avulsion or extraction of the peripheral nerves, especially the supraorbital, infraorbital, and inferior dental. (3) Operations at a point between the peripheral distribution and the ganglion of Gasser, as in the excision of Meckel's ganglion. (4) Intracranial operation, as in the removal of the ganglion or avulsion of the sensory root.

(1) **Alcoholic injections** are indicated when the neuralgia is referred to the distribution of the second or third divisions of the trigeminal nerve. Their use was popularized by Schlosser, and now has many advocates. It would seem that in many instances it might be used as a substitute for the peripheral operations, except in neuralgia of the branches of the first division, where the treatment, I believe, is contraindicated. The injections are made without an anesthetic, and the patient should enjoy immediate and complete relief. The relief, however, is only transitory, on an average perhaps seven months, when the injection may be repeated. As a rule, the intervals become shorter, so that eventually, in the graver types, it becomes necessary to resort to the major or intracranial operation. To this general rule we make exception only for those patients whose condition is such as to contraindicate surgical intervention of any kind.

Technic of Alcoholic Injections.—To be able to introduce the point of the needle into the substance of the nerve requires more experience than is usually appreciated, nor are the attending dangers of the injections altogether realized. Judging from my observations of patients so handled, many bungling attempts have been made by those wholly unprepared and inexperienced. The method which I now use does not differ materially from that previously recommended by Lévy and Baudouin. I prefer a small platinum needle to the heavier silver one usually employed, and inject 2 c.c. of an 80 per cent. alcoholic solution. After disinfecting the skin with iodin the site of the needle puncture is anesthetized with 4 per cent. solution of cocain and the skin punctured with a straight Hagedorn needle. To inject the third or inferior maxillary division the needle is introduced at the lower edge of the zygoma, at a point 2½ cm. in front of the external auditory meatus, and carried a little upward along the base of the skull to a depth of 4 to 4½ cm. To reach the second or superior maxillary division after the usual preparation of the skin the needle is introduced at the inferior margin of the zygoma, ½ cm. posterior to a vertical line corresponding to the posterior border of the orbital process of the malar bone, and carried in a direction somewhat upward into the pterygomaxillary fossa to a depth of 4½ to 5 cm. Deep alcoholic injections are not to be recommended in neuralgia of the first or the ophthalmic division. It is safer to inject the supraorbital nerve, either subcutaneously or through an open incision, at its emergence from the supraorbital groove or, as in some cases, the supraorbital foramen.

When the needle comes in contact with the nerve, the patient experiences a sudden shooting pain within the distribution of the nerve, or should the needle fail to puncture the nerve-sheath, a similar sensation will be experienced when the solution by diffusion comes in contact with the nerve trunk.

(2) **Avulsion.**—Alcoholic injections have not taken the place altogether of the peripheral operation. The latter is still indicated, I believe, when the neuralgia is confined, as it so often is, to the distribution of the supraorbital, infraorbital, or inferior dental branch. In the exceptional case the relief will be permanent, in the majority the patient will be relieved for two years or more. The operation of Thiersch, avulsion or neurexairesis, should take the place of resection. By this method not only will a considerable portion of the peripheral segment with its fine trigeminal filaments be extracted, but in some cases the central segment up to the ganglion. The exposure of the nerve is not difficult, and the operation should be attended with no mortality.

(3) Operations upon the trigeminal tract at a point between the ganglion and the points of exit of its branches have been or should be discarded. The exposure of either the second or third division at the base of the skull or the removal of Meckel's ganglion are more difficult and less radical in their results than the intracranial operation on the ganglion or its sensory root.

(4) **Intracranial Operations.**—In cases with repeated recurrence after alcoholic injections or peripheral operation, when the neuralgia is of the major type and is distributed to two or three divisions of the ganglion, when the condition of the patient justifies resort to operation, the removal of the ganglion or its sensory root should be recommended without hesitation. The technic of the operation has been so perfected that in experienced hands the mortality has been reduced to less than 2½ per cent. In upward of fifty cases I have had but one operative death, a second patient having had an apoplectic stroke after the operation, from which he did not recover. The operation should be undertaken only after considerable experience on the cadaver. Whether or not the ganglion is removed or its sensory root avulsed (Spiller's operation) is a matter of no consequence so far as the end results are concerned. In both the patient may be assured that there will be no recurrence. The author prefers the Spiller operation because it is easier of execution, it is attended with less hemorrhage, and does not expose the cavernous sinus and adjacent nerves to injury. Exposure of the ganglion may be made through an incision which is concealed within the hairline, and the cosmetic results are excellent. The profession should disabuse itself of the idea that this operation is attended with a high mortality, with considerable disfigurement, and with grave complications. These conditions no longer pertain.

DISEASES OF THE SPINAL MENINGES AND SPINAL CORD

By E. W. Taylor, M.D.

THE SPINAL MENINGES

Disease of the spinal meninges, apart from involvement of the brain, is relatively rare. Certain conditions, however, are worthy of separate consideration. Of these, hypertrophic cervical pachymeningitis, which occurs as a distinct affection, is the most important. Inflammation of the pia-arachnoid, limited to the spinal cord, is almost invariably a secondary affection, although in rare instances the meningitis may be confined to the spinal membranes.

HYPERTROPHIC CERVICAL PACHYMENINGITIS

The pathologic anatomy of hypertrophic cervical pachymeningitis is a thickening of the dura often to five or ten times the normal. As this hypertrophy takes place, there is a tendency, on the one hand, to grow into the periosteum, and on the other, to involve the pia-arachnoid, nerve-roots, and cord. The circulation, of both blood and lymph, meets with interference; compression of the cord may take place, and symptoms referable not only to the nerve-roots, but also to the cord, are induced. The etiology is wholly vague unless the hypertrophies of the dura in the cervical region, due to injury, tuberculosis, and syphilis, are included in this category. The course of the disease is progressive, giving rise to increasing sensory and motor symptoms in the arms.

Treatment.—Considering the character of the pathologic process underlying this affection, treatment is unavailing to check its progress unless it be due to syphilis. This possibility renders a vigorous antisyphilitic treatment imperative in all cases, even if other signs of the disease are lacking. Potassium iodid should be given in increasing doses up to 150 to 200 grains a day, and continued until the evidence is conclusive that no benefit is resulting. Mercury may be alternated with the iodid, but much reliance should be placed upon the former drug, as in late lesions elsewhere. Surgical interference may occasionally be justified if localizing symptoms are well defined and there is special indication of dorsal involvement of the dura. Other treatment is symptomatic, and trial may be given of the actual cautery, hydrotherapy, or electricity. Apart from a possible relief of symptoms, nothing fundamental is to be expected from such measures.

OTHER FORMS OF INVOLVEMENT OF THE DURA

More important from a practical standpoint than the so-called hypertrophic cervical pachymeningitis are affections of the dura due to carcinoma or other malignant tumors, to Pott's disease, and to the results of trauma. The dura is very frequently involved as a result of carcinomatous or sarcomatous infiltration; often, particularly in the case of carcinoma, as a metastasis from breast, stomach, or uterus. In such instances spinal symptoms may be the first to attract attention, with a symptomatology closely analogous to cervical pachymeningitis. In one case the subdural space in the cervical region was solidly infiltrated with cancer-cells, but without evidence of the disease external to the dura. The symptoms were those of a cervical pachymeningitis. Sarcomas may also invade this region of the cord. In these cases surgical treatment is alone available, but is rarely more than palliative in its effect, since the tumors are frequently of infiltrating character and, therefore, cannot be removed, and since the process is also usually secondary to disease elsewhere. (Localized tumors are elsewhere considered, p. 828).

Tuberculosis, localized as Pott's disease, may also, particularly in adults, in whom kyphosis is not conspicuous, lead to thickening of the dura and compression of the cord. The treatment of this condition is elsewhere considered (p. 853).

Injuries to the vertebral column, with or without fracture or dislocation, may lead to secondary changes in the dura over the point of injury. Such changes may be manifested by a thickening of the membranes, which is at times further increased by the existence of hemorrhage. This again may give rise to symptoms of pachymeningitis in the cervical or other region of the cord. In such cases, however, it is usual that the injury to the spinal cord is of so much more consequence than that to the dura that the latter condition either gives rise to no definite symptoms or is overlooked. Surgical interference is rarely useful in such cases, for the obvious reason that the dural process is diffuse and of such a character that its removal is exceedingly difficult.

SPINAL LEPTOMENINGITIS

Spinal leptomeningitis is, in the great majority of cases, a manifestation of a general cerebrospinal meningitis, and as such has been considered in a previous section (p. 728). In those rare cases when it occurs as a local process within the spinal canal it is usually due to a general septicemia or to conditions arising in the puerperium or in general infectious disease. The dorsal aspect of the cord is more apt to be involved than the ventral, and the lower rather than the upper portion, due to the effects of gravitation. The direct etiology of spinal meningitis is naturally identical with that of the general cerebrospinal type. The epidemic variety, due to the Diplococcus intracellularis meningitidis (Weichselbaum), is perhaps more frequently localized in the spinal cord than other varieties. A rare method of infection of the spinal meninges to the exclusion of the brain is through a laminectomy. In general, it may be said that spinal leptomeningitis is usually obscured by the more striking symptoms due to lesions of the cerebral meninges, and that its importance is very much less than the more diffuse variety, although as a source of further infection it should be carefully diagnosticated and treated.

Treatment.—The treatment of spinal leptomeningitis is similar to that of the more generalized form, except that, since it often is a local manifestation of the more general process elsewhere in the body, attention should primarily be given to the underlying disease. General infections, syphilis, and tuberculosis should be treated from the standpoint of the whole organism, and what local treatment is applied must be symptomatic. Lumbar puncture has been advised and practised extensively by certain clinicians. As a diagnostic measure it must be given a place of great importance. Its therapeutic effect, however, is still open to question, although from its relative safety it must be regarded as a perfectly legitimate procedure. In the cases where a local infection of the meninges has occurred following a surgical operation, an opening of the subdural space through the laminectomy wound is justified, with a thorough irrigation of the apparently affected area.

A positive advance of great significance in the treatment of epidemic meningitis has been the introduction, by Flexner,* of a specific anti-serum, the use of which has already greatly reduced the mortality of the disease. The earlier the serum is used in cases of meningitis, the more favorable the prognosis; it should, therefore, be given as soon as the diagnosis is established, or in certain instances even before, and should be repeated daily until the disease is under control and the organisms no longer demonstrable. In administering the serum, the spinal fluid should be allowed to run out to the fullest extent through the trocar used in the lumbar puncture, and an approximately equal amount of serum introduced into the spinal canal.† (Details and technic of this treatment are elsewhere discussed.)

THE SPINAL CORD

An accurate classification of diseases of the spinal cord becomes an increasingly difficult matter as our knowledge grows. The introduction of the neurone theory has undoubtedly done more than any other hypothesis to bring system into what up to that time had been vague and uncertain. The recent researches tending to impair the validity of the theory should not blind us to this fact. Whatever evidence may be adduced in the future, we are at present justified, from the practical standpoint, in maintaining the general validity of the theory.‡ We shall, therefore, in the necessarily imperfect classification of the diseases which follows, adhere to the neurone theory as a working hypothesis, and divide the diseases of the spinal cord into the two general categories of "Systemic Diseases" and "Diffuse Diseases." By systemic diseases is meant those processes which affect one or more neurone systems, either wholly or in part, the process, so far as understood, arising within the neurones themselves. In the second group, diffuse diseases, are included those processes in which the disease is not sharply limited to neurone systems and is usually due to conditions lying without the nervous elements. In these the blood-vessels play a predominant rôle. It is not maintained that any such division of diseases can be strictly carried out. For the present purpose, however, such a division offers the simplest method of approaching the therapeutics of spinal cord disease.

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* Flexner and Jobling: Jour. Exp. Med., January, 1908.

† Morse: Boston Med. and Surg. Jour., May 11, 1911.

‡ Such arguments, for example, as those adduced by Barker, "The Nervous System and its Constituent Neurones," p. 63, must be given due weight. See also Nissl, "Die Neuronenlehre," Jena, 1903, for a complete discussion of the entire question.

The diseases of the spinal cord in general do not offer brilliant therapeutic possibilities. Many of the processes are degenerative and exceedingly chronic in course. Those processes which are acute are, as a rule, self-limited but destructive, which again interferes with restitution of function through therapeutic means. Immediate treatment is often unavailing, and treatment of the resultant conditions frequently discouraging. It should not be supposed, however, as apparently is the wide-spread popular opinion, that treatment avails nothing in these diseases. On the contrary, there is every evidence that a great deal may be done for the relief or amelioration of symptoms, and that positive improvement of many distressing conditions may be brought about by perseverance in rational treatment. As a matter of fact, diseases of the spinal cord stand in the same category as parenchymatous changes in other organs. In all such affections therapeutic efforts are uncertain, and no more so in affections of the spinal cord than in affections of other equally important organs. The modern tendency in treatment has been toward an increasing recognition of the value of rational therapy and the decreasing value of drugs as empirically administered. Serum- and organotherapy offer hopeful fields for further investigation. As yet, however, they have accomplished little beyond pointing the way for future study. The prophylaxis of diseases of the spinal cord, which may most properly be regarded as a form of treatment, offers considerable hope. The relation of syphilis to the nervous system is continually being better understood, and the importance of treatment antedating manifestations on the part of the nervous system is being recognized. The theory of fatigue, as expounded by Edinger,* is suggestive of prophylactic possibilities in the way of a more rational treatment of the nervous system before disease has become manifest. The surgery of the spinal cord, as of the nervous system in general, is unquestionably destined to prevent many serious conditions as well as to mitigate or completely relieve those which have become established. The gradual departure from empiricism, the recognition of the nature of the morbid process with which we are dealing, a wise skepticism regarding the use of generally accepted remedies, with a feeling of confidence that much may be accomplished through the means now at our disposal, will do much toward placing the therapeutics of spinal cord diseases in a position of respect. In the discussion which follows, therefore, no attempt will be made to detail all the methods which have been used. Simplicity in treatment is desirable, and to further this end the effort will be to state the rational therapeutic possibilities on the basis of our present pathologic and clinical knowledge.

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* Edinger: "Die Aufbrauchkrankheiten des Nervensystems," Deutsche med. Woch., 1904, xxx, 1633.

SYSTEMIC AND QUASI-SYSTEMIC DISEASES OF THE SPINAL CORD

Afferent or Sensory System

TABES DORSALIS

Tabes dorsalis, or locomotor ataxia, is the best type of a sensory neurone disease. The lesion is essentially a degeneration of spinal sensory neurones, involving also not infrequently sensory neurones of the cranial nerves. Involvement of the motor systems is to be regarded as a complication rather than as an essential feature of the pathologic process. The morbid process is a degeneration arising within the neurones themselves, and progressing to their ultimate destruction. After much discussion, which still persists, the weight of the best opinion, originating with Erb, is that tabes is indirectly due to the poison of syphilis in the great majority of cases. This radical view is opposed by Leyden, who attaches small significance to the etiologic rôle of syphilis in the disease. The fact is at least established that in the experience of most observers tabes occurs in patients who have been the victims of syphilis. This is so uniformly the rule that a causal connection between the two conditions is rendered highly probable, and soon no doubt will be absolutely demonstrable, through a comprehensive use of the Wassermann serum test. Other factors in the etiology of the condition are too vague to require mention here. Edinger's theory of overtiring of certain groups of nerve-cells as a possible cause should be given some weight, although its assumptions are far from being proved. Naturally, debilitating conditions in general may be supposed to influence the onset of tabes, but beyond this we have no definite knowledge of its causes. If syphilis be the indirect cause of the disease, it should be borne in mind that the pathologic manifestations are not those of tertiary syphilis as ordinarily understood. The vascular changes are not apparent, and the formation of gummatous deposits does not occur. The term para-syphilitic has, therefore, been applied to the disease in order to distinguish it from a definite tertiary lesion, which is also common in the nervous system. Certain cases have been reported in which actual tertiary syphilitic lesions have coexisted with a true tabetic process. These cases lend weight to the theory of the causal relationship.

Tabes is insidious in onset, extremely chronic in course, and finally disabling through the progress of sensory disorders. There is no tendency toward spontaneous recovery, and it may, in general, be said that no authentic cases of tabes have ever recovered, although such a possibility is not to be absolutely denied. On the other hand, we are not justified in regarding tabes as in itself a fatal disease, as pointed out by Gowers. Death ensues almost invariably from an intercurrent affection or from avoidable accidents, such as the formation of bedsores, development of a cystitis, or other result of a faulty sensory innervation.

The foregoing facts, however, should not imply that treatment is unavailing. There are few conditions in which the main symptom—in this case incoördination, which secondarily leads to grave disturbances —may be treated with such effect as here. What we hope to achieve by treatment is not, in the present stage of our knowledge, to overcome the morbid degenerative process, but rather so to treat the symptoms that the disabling stage of the disease may be postponed to the latest possible time, and that the various annoying and often distressing symptoms may be ameliorated. Certain rational methods of treatment introduced within the last few years should go far toward changing our attitude regarding the hopelessness of this condition.

Treatment.—If syphilis be accepted as the main etiologic factor in the production of the degenerations of tabes, it is natural and proper that treatment should be directed against this cause. Inasmuch as the lesions do not present the ordinary type of tertiary syphilis, however, the expectation of relief by anti-syphilitic measures is exceedingly small. In the later stages of the disease there is no satisfactory evidence that anti-syphilitic remedies do any fundamental good, and, according to Oppenheim and others, the administration of mercury may be positively harmful as increasing the atrophy of the neurones, particularly in the optic nerve. Iodid of potash appears not to have this deleterious effect, and may justifiably be administered in moderate dosage throughout the course of the disease. In the very early stages of the disease, on the contrary, a vigorous anti-syphilitic treatment should be administered in the hope that the often vague early symptoms may be due to an actual tertiary lesion. It is a recognized fact that the early stages of cerebrospinal syphilis and tabes may be strikingly similar, and the patient should always be given the benefit of this doubt. The indiscriminate use of the anti-syphilitic drugs in the treatment of tabes, at any or all stages, should, however, be absolutely deprecated. Very recently the question has arisen regarding the use of salvarsan—"606" of Ehrlich—in the treatment of tabes.* In the present uncertain state of our knowledge regarding the exact relationship of tabes to syphilis, the use of this drug must be regarded as essentially experimental. It is clear that those parts of the nervous system that are definitely degenerated cannot be affected by the use of the drug; on the other hand, if, as seems possible, actual syphilitic lesions coexist with the degenerative condition, the benefit of salvarsan is apparent. The evidence has varied somewhat, but, on the whole, the consensus of opinion now is that the drug is less dangerous than at first supposed, and may exert a favorable influence on many of the symptoms of tabes. Lancinating pains, gastric crises, ataxia, and other symptoms have apparently been benefited. Disappearance of trophic ulcers has also been described. It should, however, be remembered that tabetics are peculiarly prone to be superficially benefited by new forms of treatment, and that this element of suggestibility must be eliminated before anything definite may be said upon the actual curative or beneficial effect of the drug on the process itself.

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* Wechselmann (introduction by Ehrlich), translation by Wolbarst, "The Treatment of Syphilis with Salvarsan," Rebman Co., 1911.

If we accept, even as a possibility, Edinger's carefully worked-out theory of fatigue as one of the causes of tabetic degeneration, an evident suggestion for treatment is given. The patient should be warned from the outset not to overdo and to spare his muscular system from all undue fatigue. This should be a routine direction in the preataxic as well as in the later stages. Much harm has no doubt been done by a neglect of this simple therapeutic measure.

On the other hand, it is clearly essential that a certain amount of exercise should be taken with regularity in order to keep the muscular system in the best possible condition to withstand the inroads of disease. To accomplish this result an early recourse to systematic coördinative exercises, as advocated by Fränkel,* should be adopted. To Fränkel more than to any other one investigator we owe the rational treatment of the ataxia of tabes, and, secondarily, of the other symptoms which are more or less dependent upon incoördination. The essential feature of the Fränkel treatment lies in a retraining of the coördination through systematized exercises proceeding from the simple to the complex, and practised in both the lying and the standing position. In carrying out these exercises he insists upon moderation, careful observation of the pulse-rate as a warning against exhaustion, and a complete mastery of simple exercises before more complicated ones are undertaken. In addition to these general directions it is necessary for complete success that the minutest attention be given to detail in the performance of individual movements. If these directions are faithfully carried out, improvement of a most marked degree is sure to result in all cases in which the ataxia has not reached an exceedingly high grade, or in which complicating disease does not exist. This treatment should be given over to a trained person, preferably one skilled in massage. The ordinary physician has not the time to carry it out as it should be done, and the failures are in most cases due to the imperfect methods employed. The treatment may be undertaken in the preataxic stage, although such cases somewhat rarely come to the attention of the physician. When the ataxia is already marked, and the patient is becoming conscious of his infirmity, the probability of his complete coöperation is very greatly enhanced, and his interest in the results of the treatment increased. Among intelligent patients, with an enthusiastic instructor, there is no danger of a lack of complete coöperation. Not only does this form of rational treatment lead to a most remarkable improvement in the ataxia, but, through the actual physical exercise provided and the mental effect produced by visible results, other symptoms, of an objective and subjective sort, are unquestionably ameliorated. The method marks a most significant step in the treatment of tabes, and stands as one of the most valuable additions in recent years to the therapeutics of the organic nervous affections. If there be very great loss of sensibility, the results of treatment by the Fränkel method are less satisfactory. It is also important that the movements should be guided by the eyes; hence early optic nerve atrophy complicates the treatment. Contraindications for successful treatment are: blindness, extreme hypotonia, and heart disease.

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* Fränkel: "The Treatment of Tabetic Ataxia by Means of Systematic Exercise," English translation, 1902.

Other forms of treatment must take a subordinate place, although they doubtless have their uses in modifying the course of the disease and particularly in the relief of certain distressing symptoms. Electricity has long been advocated and has been extensively employed. As a general tonic agent it no doubt has its place; that it definitely affects the course of the disease is no longer to be regarded as probable. Galvanism may be applied over the spine, one pole at the neck and the other in the lumbosacral region, and faradism also has its value, applied by a brush over the vertebral column, or in the form of general faradization. Hydrotherapy occupies a position somewhat similar to that of massage. As a general measure it is no doubt useful; as a specific form of treatment it is essentially unavailing. The baths at Oeynhausen, Nauheim, and Wildbad have been recommended, but it should be borne in mind that the hydrotherapeutic establishments in this country, owing largely to the energy of Dr. Simon Baruch, may in great measure take the place of the foreign baths. The treatment by suspension, as originally advocated by Motschutowsky, has largely fallen into disuse. When practised, it appears to have accomplished results, no doubt through mechanical means, by stimulating the circulation in and about the spinal cord. The treatment may be carried out by an apparatus which suspends the patient from the shoulders through straps passing under the arms and about the head, attaching to a weight passing over a pulley above the patient's head. The treatment at best is somewhat violent, and great care should be taken to avoid an undue strain upon the vascular system, particularly in arteriosclerotic subjects.* The systematic use of serums is not yet justified by our knowledge and experience, though here again favorable results have been claimed.

Massage as a therapeutic measure has relatively little place in the treatment of tabes, apart from its general usefulness. As an adjuvant to other methods, it is frequently grateful to the patient, and in so far helpful. In somewhat debilitated persons it may well be combined with the Fränkel exercises.

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* A systematic trial of this treatment some years ago at the Massachusetts General Hospital gave temporarily encouraging results. The element of suggestion was, however, not to be excluded.

Drugs are of symptomatic use merely. Many have been used with varying results, but we have no means of drug treatment which approaches a specific. Nitrate of silver, formerly much employed, is now rarely used. Iodid of potash and mercury are in general given too freely rather than too sparingly. Strychnin as a general nerve tonic is at times useful, but no dependence is to be placed upon it. It has been particularly used to combat optic nerve atrophy.

The pains of tabes, in their wide diversity of manifestation, constantly demand attention. The occasional typical lancinating pain is exceedingly difficult of treatment because of its fleeting character. It is often unwise to attempt the relief of such pains except by general methods. When they become more persistent and recur at short intervals, however, recourse must be had to the pain-stilling drugs, beginning with phenacetin and its congeners and ending with morphin. Morphin should naturally be the last resort, but it is frequently required. The salicylates are often useful, of which the newer preparation, aspirin, is to be preferred, in doses of 10 grains, repeated every three or four hours. The pain associated with the various crises of tabes, of which the gastric crisis is the most distressing, is self-limited, but during the continuance of the crisis must be controlled. Oxalate of cerium in doses of 5 grains, repeated, has long been recommended for the gastric crisis. Here, again, however, morphin is often required. In one case under my care hydrobromate of hyoscin gave relief where morphin failed.

Rectal and vesical incontinence or retention are annoying and stubborn symptoms. Every care must be taken to regulate the bowel function by the discriminating use of cathartics and enemas. The bladder difficulty may often be benefited by absolute regularity, by washing out the bladder with sterile water, by regular catheterization if necessary, by the passage of sounds, and by galvanization of the bladder, the current passing between the perineum and the suprapubic region.* Incontinence may be benefited by passing the urine at frequent intervals and with absolute regularity.

A frequent complication of the late stages of tabes, as of other chronic affections, is the formation of bedsores. Owing to the marked sensory disturbance always present in the disease, causes of skin irritation are frequently overlooked, and the nurse or attendant should be specifically warned that the danger of bedsores is peculiarly great in this condition, and that, if formed, they heal much less readily than in many other diseases. The preventive treatment of bedsores must be insisted upon. This is accomplished by absolute cleanliness and freedom from sources of irritation of all sorts in those parts of the body exposed to pressure. Faithful bathing, sponging with cool water and alcohol, and scrupulous attention to the bed and clothing of the patient, should suffice as prophylactic measures. Should a bedsore develop, surgical cleanliness is demanded.

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* J. D. Barney: "The Care and Management of the Tabetic Bladder," Boston Med. and Surg. Jour., December 22, 1910.

Efferent or Motor System

For purposes of practical classification the sensory peripheral motor neurone alone demands consideration. In the efferent or motor system, on the other hand, it is of great practical importance to separate the affections of the upper or corticospinal motor neurone from those involving the peripheral motor neurone. Together, these neurones constitute the path of voluntary muscular control, but, owing to the fact that the upper neurone has no direct connection with the muscles, whereas the lower neurone is essential to the integrity of the muscular system, the resultant signs and symptoms, when one or the other is involved, are manifestly different, the one feature in common being motor weakness. If, finally, both the upper and lower motor neurones are involved together, a symptom-complex results which combines the symptomatology of each. Lesions of the upper neurone lead to hypertonicity of the muscles, increased deep reflexes and spasticity, without muscular atrophy or electric alterations. Lesions of the lower neurones give rise to hypotonicity of the muscular system, diminution or loss of the deep reflexes, muscular atrophy, with electric alterations. Lesions of both neurones give a combination of spasticity with muscular atrophy, depending in degree upon the relative extent to which one or the other system of neurones is involved.

Upper Motor Neurone

The upper motor neurone may be involved in any part of its course from the cortex to its termination in the lower portion of the spinal cord, by either injury or disease. The symptomatology naturally varies with the segment involved, but in general the condition produced is one of spastic paralysis with exaggeration of the reflexes below the point of the lesion. The resultant conditions also differ in relation to the period of life at which the injury or disease occurred. The final result is a tendency to rigidity and contractures, and to the relief of these conditions our therapeutic efforts are directed. In general, the outlook for treatment is not encouraging, inasmuch as damage to the central nervous system once effected is incapable of repair. From the advance of cerebrospinal surgery the possibility of relieving certain of the conditions which lead to the secondary spasticity is offering more encouragement than heretofore.

HEREDITARY SPASTIC PARAPLEGIA

This condition, described by Strümpell, and in this country by Spiller, is a family disease, usually beginning between the twentieth and thirtieth years, extremely chronic in course, and characterized essentially by spasticity of the legs with its inevitable accompaniments. The hypertonicity of the muscles predominates to the end over the paresis. Slight sensory disturbances, which usually supervene toward the end, remove the disease in the great majority of cases from the category of pure lateral sclerosis. Many of the cases are probably cerebral in origin, with secondary degeneration of the pyramidal tracts. Syphilis has been ascribed as the cause of the condition, but its etiology is otherwise wholly vague.

The disease is degenerative and progressive. Its attempted treatment is, therefore, unavailing beyond such general measures as may tend to maintain the patient's condition. Drugs accomplish nothing, and mechanical treatment affords the only basis of hope. Massage, skilfully applied, is often beneficial. Warm baths tend to relax the spasm, and surgical interference is at times useful to counteract the effect of contractures. Too much treatment is often more harmful than too little. Care must always be taken not to overwork the muscles, which are already in a hypertonic condition.

SPASTIC PARALYSIS OF INFANTS—HEMIPLEGIA; DIPLEGIA

Unilateral or bilateral spasticity of infants extending into adult life is an extremely common condition. It is due to cerebral disease or injury from the most diversified causes involving the motor areas of the brain. If the lesion be on one side of the brain, the result is naturally a hemiplegia; if both sides are involved, a diplegia or quadriplegia results. The cause of the subsequent defect is in general to be traced to intrauterine conditions or lesions occurring at birth or to changes taking place in the brain shortly after birth; but the exact character of the lesion, whether due to hemorrhage, softening, congenital defect, or inflammation, is most varied. The condition generally described as Little's disease, as pointed out by Sachs and others, shows no similarity of pathologic changes. Hereditary syphilis, uterine trauma, and possibly the psychic condition of the mother during pregnancy may lead to cerebral defect in the child. Premature birth, difficult birth, and faulty position of the fetus are all of importance. Particular significance should be attached to the slow descent of the head through the superior strait, leading undoubtedly in certain cases to a destructive anemia of the brain. The application of forceps in skilled hands is undoubtedly less dangerous to the child than a long-delayed birth. When carelessly applied, meningeal hemorrhage is a possible result. Of the extrauterine conditions which may ultimately lead to spastic paralysis, importance should be given to the occurrence of acute non-suppurative encephalitis of the motor region, as described by Strümpell, a condition in some of its forms closely allied to acute anterior poliomyelitis. Localized injuries to the brain from external causes may likewise lead to a destruction of the motor area, or even to an artificial porencephaly. It should always be borne in mind that hemiplegia in infants and children is, in the great majority of cases, due to cortical and subcortical lesions rather than to lesion in the internal capsule, as in the adult.

Treatment.—Patients ordinarily present themselves for treatment after the spastic conditions dependent upon the diversified cerebral lesions alluded to above have become well established. Our therapeutic measures, therefore, resolve themselves into an amelioration of the spasticity and its attendant deformities. It is of the utmost importance that the patients be not allowed to walk early, even should they show such a desire. The defective nerve-tracts must be spared far more than if they were normal. The general spasticity must be treated, as already suggested, by warm baths, gentle but persistent massage, and exercises designed to counteract the tendency to contracture. Drugs are wholly unavailing to influence the underlying condition, except possibly in those cases where syphilis is a factor. A more promising field of treatment is offered by surgery. Much may undoubtedly be done by tenotomy in those cases in which contractures predominate over the paralysis. In markedly paralytic cases such an operation is obviously unavailing. Surgical interference should always be followed by painstaking orthopedic treatment extending over a long period of time. By these means a decided amelioration of the deformities may be attained. Cushing * has recently drawn attention, with a report of certain very striking cases, to the possibility of relieving cerebral hemorrhages in the newborn by immediate operation, thereby removing the conditions likely to lead to permanent cerebral defect. A further radical measure, advocated by Spiller, Frazier, Alfred S. Taylor, and others, is to cut the dorsal nerve-roots, for the purpose of overcoming high degrees of spasticity, on the theory that the spasm will be lessened by an interruption of the reflex arc.

SPASTIC PARALYSIS OF ADULTS—PRIMARY LATERAL SCLEROSIS

This condition† is one of the least frequent of the organic diseases of the nervous system. It has rarely been verified by autopsy, and undoubtedly seldom occurs in pure form. It is frequently the predominant sign of more extended lesions, but, although worthy of mention as a distinct form of disease, it has small practical significance. Its treatment is that of bilateral spastic paralysis in general.

SECONDARY DEGENERATION

In all destructive lesions of the spinal cord, as of the central nervous system in general, permanent secondary degeneration takes place following the separation of an axone from its cell of origin. It follows, therefore, that in the various conditions of spastic paralysis which we have been considering secondary degenerations in the pyramidal tracts inevitably occur. As a result of this degeneration the spastic condition of the extremities becomes fixed and the general clinical picture is thereby rendered the more hopeless. Nothing is to be done for these degenerations as such. No means have as yet been found to check the pathologic process, although it is possible that the vigorous administration of strychnin may delay it somewhat. Together with the

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* Cushing: "Surgical Intervention for Intracranial Hemorrhages of the Newborn," Amer. Jour. Med. Sci., 1905, cxxx, 563.

† Erb: "Spastic and Syphilitic Spinal Paralysis," Lancet, Oct. 11, 1902.

original causative lesion, this secondary degeneration completes the pathologic process underlying spasticity.

Lower Motor Neurone

In marked contrast to the symptomatology produced by lesions of the upper motor neurone is that induced by a lesion of the lower neurone in its course from the ventral horn of the spinal cord to the muscles. In the latter case the resultant paralysis is flaccid and atrophic in type, leading to hypotonicity of the muscles, with accompanying alterations in electric reaction. The tendon reflexes, owing to the cutting of the reflex arc, are diminished or lost, in contrast to the exaggeration of the reflexes characteristic of lesions of the upper neurone. The affections of the lower neurone may be either insidious in onset and chronic in course, or sudden in onset with a tendency toward partial recovery. In the first instance the pathologic process is primarily degenerative, and in the second it is primarily destructive, the cause acting over a brief period of time. An example of the first type is progressive muscular atrophy of the Aran-Duchenne type; and of the second, acute anterior poliomyelitis. The latter, strictly speaking, is not a neurone disease, and may only be so included as an assistance in classification.

PROGRESSIVE MUSCULAR ATROPHY

Spinal progressive muscular atrophy is an example of a neurone disease involving essentially the peripheral motor neurone. Pathologically, there is degeneration of this system of neurones without evidence of cause external to the neurones themselves. The result is a gradual disintegration of the peripheral motor nerve elements, with accompanying muscular atrophy in the parts involved. The association of this lesion with a degeneration of the corticospinal motor neurone is considered below (under Amyotrophic Lateral Sclerosis). The process in its typical form begins in the cervical region, and hence involves the muscles of the upper extremity first, beginning with the small hand muscles. The muscles are atrophic from the first and the progress of the atrophy is indicated by fibrillation of the muscle-bundles. The fibrillation, however, must not be regarded as pathognomonic. This form of muscular atrophy is to be sharply distinguished from the primary myopathies discussed in another section of this book. The progress of the degeneration usually leads to an involvement of the bulb, with a paralysis of deglutition and respiratory failure. The legs are rarely involved.

Treatment.—Treatment of this disease is peculiarly unavailing. Gowers has advocated strychnin, and Hammond * more recently has asserted its efficacy in checking certain degenerative processes in the nervous system. He has used as much as ⅔ grain three times a day in progressive muscular atrophy with apparently favorable result. The muscles involved in the process must be carefully guarded from overwork; hence the undesirability of too vigorous massage and gymnastic exercises in general. Moderation must also be practised in the exercise of muscles not yet involved. Electricity may be used, but it should be applied sparingly. The benefi tis rarely apparent, and harm may unquestionably be done by overstimulation. The progress of the disease is extremely slow, and the patients instinctively acquire the ability to make use of defective muscles and also to use those which are intact to the best possible advantage. The complete absence of pain and sensory disorders renders the disease more bearable than it otherwise would be, and obviates the necessity for symptomatic treatment.

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* Hammond: "The Treatment of Degenerative Diseases of the Nervous System by Massive Doses of Strychnin with Special Reference to Tabes Dorsalis, Progressive Muscular Atrophy, Optic Nerve Atrophy, and Pseudo-muscular Hypertrophy," Boston Med. and Surg. Jour., cxlix, 223, 1903.

NEUROTIC OR NEURAL FORM OF PROGRESSIVE MUSCULAR ATROPHY—PERINEAL TYPE OF PROGRESSIVE MUSCULAR ATROPHY

(Charcot-Marie)

This affection usually attacks more than one member of a family, and the muscles of the feet are first affected, especially the peronei, the extensor communis digitorum, and the small muscles of the foot. Club-feet, claw-feet, and various forms of talipes may ultimately develop. The upper extremities are later affected. The pathologic anatomy of this condition is obscure. It is probably, strictly speaking, not to be classed as a lesion of the peripheral motor neurone alone. There are, for example, occasional sensory disorders, and doubt has even been raised as to whether it is to be regarded as an independent disease. Lesions of the peripheral nerves and of the cord in its ventral, dorsal, and lateral tracts have been described. It is possibly related also to the myopathies.

The treatment is to be carried out on the principles already laid down. The disease is slow in course and may at times come to a standstill. Surgical methods are often useful to relieve the contractures which may early develop.

ACUTE ANTERIOR POLIOMYELITIS

This disease is of special importance because of the increasing frequency of its occurrence, and also because of the lamentable results to which it leads in later life. The cause, long obscure, is now known to be an infection due to a filterable virus which may be isolated, and is capable of reproducing the disease in monkeys. The character of the virus is not known, and no organism has been discovered. The researches of Flexner and Lewis* have established beyond question the foregoing facts. The pathologic anatomy of the condition is an acute inflammatory process with few leukocytes in the exudate, widely distributed in the initial stages over the entire central nervous system, constituting a true meningitis. Later the inflammatory process, together with the destructive virus itself, is apt to invade those portions of the cord or brain containing motor nerve-cells, leading to a greater or less degree of destruction. Many cases have now been studied shortly after the onset; they show an external exudate, together with a varying degree of involvement, particularly of the ventral horns of the cord, or the nuclei of the brain stem. An inflammatory exudate within the substance of the cord or brain is frequently demonstrable, with secondary destruction of nerve-cells. Recent investigation tends to show that the peripheral nerves may also be primarily involved, a fact which the clinical observation of the past few years substantiates. Later alterations on the pathologic side consist in degeneration of cells and their processes, with consequent muscular atrophy. Further evidence of the infectious character of the original process has long been furnished through the appearance of the disease in epidemic form, as described by Medin, Caverly, Painter, Lovett and Emerson, Harbitz and Scheel, and especially by Wickman.* The onset of the disease distinguishes it sharply from the type just discussed, of which progressive muscular atrophy is an example. In the latter case atrophy first appears, followed later by paralysis, whereas in poliomyelitis the paralysis is immediate, and a tendency to recovery marked.

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* Flexner and Lewis, Jour. Amer. Med. Assoc., November 13, 1909, and in succeeding numbers at varying intervals.

On the clinical side the disease is characterized by a rise of temperature and general signs of infection, followed by loss of power, most frequently in one leg or one arm, but often in both legs, and occasionally in all four extremities, and not infrequently in the distribution of the cranial nerves. The subsequent atrophy and flaccid paralysis is often limited to groups of muscles which, under normal conditions, act in common. As the patient gradually recovers from the first shock of the infection, deformities and malpositions develop as a result of the incomplete equilibrium between antagonistic groups of muscles. The outcome is deformity of varying degree: in the foot, often a pes equinovarus or other faulty position due to a paralysis of one or another group of muscles. In those cases in which the body muscles are involved, various degrees of scoliosis and lordosis may develop. The general relaxation of ligaments due to the muscular atrophy is an important element in the disability produced by the disease. At the shoulder-joint, for example, spontaneous luxations are not uncommon, owing to the relaxed condition of the structures surrounding the joint.

Treatment.—The problem of treatment in infantile poliomyelitis lies rather with the end-results of the disease than with its onset. Having no definite knowledge of its etiology, prophylaxis is impossible. The acute onset is often regarded lightly by parents until the paralysis has developed. Should the physician be called at this early stage, however, the treatment should be that of other infectious processes, namely, absolute rest in bed, free opening of the bowels, and a low diet. A counterirritant and diaphoretic treatment may also in certain cases be advisable. The administration of urotropin is justified,—gr. v one to five times daily,—in the hope that it may serve to render innocuous the virus in the cerebrospinal fluid. Evidence at present does not justify great hope in this procedure. The original infection is often slight, so far as its systemic effect is concerned, and the children are quite well again after a few days, except for the resulting paralysis. It is well to wait from two to three weeks before instituting mechanical treatment. A systematic course of electricity and massage with exercises should then be begun. The difficulties in the very young child are manifest. Electricity is often alarming, and the fat layer is thick, rendering a satisfactory stimulation of the muscles practically impossible by currents which can be borne. Massage of the muscles is more efficacious in the infant, and with a skilled masseuse may be applied with benefit and without discomfort to the patient. In older children electricity may be used with advantage. In degenerated muscles, showing a reaction of degeneration, the galvanic current should be chosen, the active pole being positive in case of highly degenerated muscles, and negative if the reaction of degeneration is not complete. If the muscles respond to faradism, this form of current should be used. The stimulation of muscles by electricity is unquestionably of benefit, at least on the mechanical side. Equally important, and perhaps more so, in certain cases, is massage given by a competent person. All those devices which tend to improve the circulation of the affected part and to develop the muscles are desirable, care being taken to avoid overfatigue and to prevent the stretching of partially paralyzed muscles by suitable appliances. Later, in older children, gymnastic practice under proper instruction is useful, especially such as is designed to develop those groups of muscles which are suffering through overaction of antagonists. Passive movements are also valuable in the attempt to overcome the paralytic contractures. There is evidence to show that a faithful use of these mechanical methods, continued for months or years, will lead, even after long periods of time, to continued improvement. The limit of direct improvement is naturally reached when the atrophied muscles show no further tendency toward recovery. In those cases in which paralytic deformities of a marked sort have developed through the antagonistic action of groups of muscles surgery may accomplish much through tenotomies and muscle transplantation.

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* Wickman, Beiträge zur Kenntnis der Heine-Medinschen Krankheit, Berlin, 1907. See also recent reports of the Mass. State Board of Health, and the report of the Collective Investigation Committee of the New York Epidemic of 1907. Nervous and Mental Disease Monograph Series, No. 6.

ACUTE ANTERIOR POLIOMYELITIS OF ADULTS

A disease identical with acute poliomyelitis in infants occurs also in adults, though far less frequently. The pathologic alterations are the same as in the infantile form, though, perhaps, somewhat more extensive in distribution. The clinical course is naturally similar, modified only by the greater age of the patient. The onset is often less sudden, however, than in the young child, and may closely simulate the somewhat uncertain symptom-complex known as Landry's paralysis.

Treatment.—The treatment is entirely similar to that of the infantile form, except that the complication of shortening of the limbs and the consequent disturbances associated with the muscular system naturally do not occur.

SUBACUTE AND CHRONIC POLIOMYELITIS

The conditions of so-called subacute and chronic poliomyelitis have no importance in this connection. The distinction between chronic poliomyelitis and progressive muscular atrophy is a doubtful one, and for many reasons it seems desirable not to burden the nomenclature of the spinal cord affections with these somewhat uncertain transitional forms of disease.

Upper and Lower Motor Neurones

Under certain conditions of disease both the upper and the lower motor neurones may be involved. When this occurs, there is an association of muscular atrophy with spasticity, the degree of spasticity or of atrophy being determined by the extent to which the upper and lower neurones are involved respectively. The general treatment, therefore, of these relatively infrequent affections of the nervous system is a combination of the methods suggested for the spastic paralyses and those for the atrophic paralyses associated with flaccidity.

AMYOTROPHIC LATERAL SCLEROSIS

This disease, often and very properly considered a spastic form of progressive muscular atrophy, is the best example of a combined lesion of the upper and lower motor neurones. In typical cases the degeneration begins simultaneously in the neurones of the pyramidal tract and in those extending from the ventral horns to the muscles. Inasmuch as the ventral horn neurones are primarily involved, as in uncomplicated progressive muscular atrophy in the cervical enlargement, it results that an atrophic condition of the small hand muscles is early associated with a marked spasticity, with exaggerated deep reflexes of the legs. The disease, through the gradual disintegration of these neurones, finally leads to a pronounced picture of progressive muscular atrophy involving chiefly the upper extremities, associated with a definite spastic paraplegia without atrophy of the leg or feet muscles. Death usually results from an extension of the disease to the oblongata. The lumbar cord is rarely involved in its ventral portions, hence the maintenance of the spasticity of the lower extremities with the flaccid and atrophic paralysis of the upper. The course of the disease is exceedingly slow, but invariably progressive.

Treatment.—We have absolutely no means of checking the progress of the disease, except through a sparing of the muscular system and a possible use of massive doses of strychnin.* What may be done to alleviate the situation has been already described under the respective headings of disease of the upper and lower motor neurones. Means must be taken to overcome the spasm and to guard at least against a rapid spread of the atrophy. The later stages of the disease are distressing both to the patient and to the physician, because of the frequent paralysis of the tongue and of the muscles of deglutition. Artificial feeding must be resorted to toward the end, but in spite of every effort the patients usually die of a modified starvation.

PROGRESSIVE BULBAR PARALYSIS

A condition closely allied to amyotrophic lateral sclerosis and to its associated condition of progressive muscular atrophy without involvement of the pyramidal tract often begins in the nuclei of the oblongata, affecting chiefly the nucleus of the hypoglossal and of the accessory vagus-glossopharyngeal group. The pathologic process is identical with that of amyotrophic lateral sclerosis, and, as just stated, may often be its terminal stage through extension. If occurring in the oblongata alone, the clinical picture is of a slowly progressive difficulty in speech through paralysis of the tongue, and of deglutition by involvement of the pharyngeal muscles. An entirely similar process may involve the upper nerve nuclei, including the neurones innervating the muscles of the eye, and give rise to the condition known as chronic ophthalmoplegia. Precisely as in the spinal forms of muscular atrophy, the pyramidal tracts may or may not be involved in the bulbar forms, and, naturally, the same clinical results follow either an atrophic paralysis of the muscles supplied by the individual nerves or a similar atrophic paralysis with the spastic element superadded.

Treatment.—The treatment of this condition is altogether discouraging. Drugs do not meet the difficulty, and mechanical treatment is almost impossible to carry out, owing to the difficulty of reaching the parts involved. As the speech gradually becomes affected through palsy of the tongue, and the enunciation of various sounds becomes more and more difficult, a training of the patient in enunciation may accomplish something, which is quickly lost, however, through the inevitable progress of the disease. In general, nothing can be accomplished worthy the name of treatment, except rendering the patient as comfortable as his most unfortunate situation permits. When paralysis of deglutition sets in, it has been suggested that stimulation of the throat muscles by electricity may be useful in arousing artificial swallowing movements. This, however, is a somewhat fruitless prolongation of a condition which does not permit of actual improvement. Artificial feeding finally becomes a necessity, first, through a tube reaching to the pharynx, and later, into the stomach. Feeding by the rectum is the last resort. The progressive paralyses due to an involvement of the upper nuclei likewise permit of no special treatment.

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* It should be borne in mind that if the spasticity be excessive, strychnin should be used sparingly, if at all.

ACUTE BULBAR PARALYSIS

Acute bulbar paralysis is a condition analogous to anterior poliomyelitis in that it involves bulbar motor nerves in the same sense that ventral horn neurones are involved. The pathologic anatomy of the condition is far more varied, however, than that of poliomyelitis, and, in fact, is usually due to primary disorders of the blood-vessels without specific infection. A usual cause of the bulbar symptoms is a thrombosis of the vertebral arteries, of the basilar or of their branches. Embolism is unusual, as is a primary hemorrhage. When the disease occurs as an acute inferior polioencephalitis, the analogy to poliomyelitis is complete. In fact poliomyelitis not infrequently manifests itself alone in the oblongata, constituting an acute bulbar paralysis. Strictly speaking, the varying processes which lead to acute bulbar paralysis are not types of neurone diseases, although the symptomatology makes such a terminology convenient. Similar processes may extend throughout the pons and into the quadrigeminal region.

The clinical picture of the typical acute bulbar paralysis is a palsy, more or less complete, of the bulbar nerves, and especially of the hypoglossal and the vagus-glossopharyngeal group on its motor side. A paraplegia or hemiplegia is likely also to result from destruction of both or one pyramidal tract. If the lesion lies higher in the brain stem, the cranial nerves involved in the process naturally show its position. (For further consideration of cranial nerve diseases see p. 759.)

Treatment.—The prophylaxis of the foregoing conditions is naturally important and at times possible. Inasmuch as the lesions are almost invariably due to vascular disorders, which are a part of a more extensive circulatory disturbance, the heart demands the closest attention. The vague signs and symptoms on the part of the nervous system of a generalized arteriosclerosis or weakened heart should forewarn the practitioner of the possibility of bulbar disease, although naturally it is far less frequent than disturbances in the brain itself. If the disorder be developed and the patient survive the first few days, the treatment should be governed by the general directions already laid down in the care of the chronic form. Restoration of function is not likely, although certain improvement may take place, as in primarily destructive lesions elsewhere. Drugs are unavailing, except such as tend toward a strengthening of the general circulation.

MYASTHENIA GRAVIS PSEUDOPARALYTICA—ASTHENIC (BULBAR) PARALYSIS

Erb was the first to call attention to a symptom-complex characterized by an apparent involvement of peripheral motor neurones, to which was later given the name of myasthenia gravis or asthenic bulbar paralysis. Although various alterations have been described by different writers, the pathologic anatomy of the condition is too vague to take it out of the category of the neuroses. Its characteristic symptoms are palsy of the bulbar nerves, and often of the external ocular muscles, with ptosis, with marked weakness of the extremities and of the neck muscles, without objective sensory disorder. The muscles do not atrophy, nor is there reaction of degeneration. A rapid tiring of the muscles on electric stimulation, known as the myasthenic reaction, has frequently been observed, however. The course of the disease is protracted; it is always serious, and the patient is never free from the danger of death from involvement of the respiratory apparatus.

Treatment.—Treatment is negative rather than positive. There is much danger in attempting too much, and small risk of failing in our duty by attempting too little. Electricity should be avoided as contributing to the muscular tire. The muscles should in every way be spared. The stomach-tube should be used only with the greatest caution, since its passage is likely to excite much greater muscular effort than the attempt to swallow food naturally. Oppenheim relates a case in which death ensued from this cause. A careful régime of life, with general tonic measures, is as much as we can at present do for the disease. The removal of certain muscle tumors (Weigert, Hun), which in some cases appear to have an etiologic relationship with the muscular weakness, is a rational, if not particularly hopeful, procedure.

Combined Neurone Diseases

Under the general heading of combined neurone or combined system diseases are included those affections of a systemic or quasi-systemic character which involve both sensory and motor elements, the ordinary combination of lesions being degenerations of the primary sensory neurones and of the secondary motor neurones. The direct cerebellar tracts may also at times be involved to a greater or less extent, as well as others of less understood function. The essential feature, however, of this type of disease is a combination of sensory and motor symptoms coexisting in varying degrees. The ventral horns are not involved.

ATAXIC PARAPLEGIA

The term ataxic paraplegia is the clinical expression of a variety of pathologic alterations of most diverse etiology. On the clinical side, and for the general purposes of treatment, with which we are now concerned, it is not essential to discuss the types and degrees of pathologic alteration which lead to the general symptom-complex of an ataxic paraplegia. The evidence is conclusive that many of these lesions are quasi-systemic in character, involving more than those tracts the lesion of which gives rise to symptoms. The term diffuse combined degeneration is applicable to these lesions. In the majority of cases the cause of the degeneration is exogenous, arising from or through the agency of the blood-vessels, and is not, therefore, to be regarded as a primary neurone degeneration. It is still possible, however, that a certain number of cases represent a true primary neurone degeneration involving the peripheral sensory neurone and the central motor neurone. In the present state of our knowledge the clinical disease, ataxic paraplegia, may be divided into the following pathologic groups:

(1) Diffuse combined degeneration of the cord; (2) combined dorsal and lateral systemic degeneration (neurone disease); (3) combined systemic disease as a result of congenital defect (Friedreich's and cerebellar ataxia) and in dementia paralytica.

The first of these, diffuse combined degeneration of the cord, is not to be regarded as a system disease in the strict use of that term. The lesions involve the dorsal and lateral tracts, but spread beyond their confines. Anemia of the pernicious type is a common cause of this degeneration, although it has undoubtedly been given undue importance. Equally and probably more significant in its production is general cachexia from diverse causes or toxemia, using that term in its broadest sense. The general pathologic alterations of this group are: a diffuse degeneration limited essentially to the cord, a constant involvement of the dorsal and lateral columns without strict regard to neurone systems, a predominance of the lesion in the thoracic and cervical regions, freedom from degeneration of nerve-roots and peripheral nerves, a non-involvement of gray matter, and usually insignificant vessel changes.

The etiology of this type of degeneration, so far as it may be learned, is of value in marking out the treatment. Syphilis may be disregarded. General cachexia and poor nutrition, pernicious anemia, lead-poisoning, malaria, grave secondary anemia, and possibly leukemia are possible causes. The course of the disease is progressive, and often rapidly so, and its symptoms are determined by the involvement of the dorsal and lateral tracts, giving the general symptom-complex of disordered sensation, with its accompanying ataxia combined with exaggerated deep reflexes.

Treatment.—More than in most diseases of the spinal cord it is absolutely essential, when the foregoing group of symptoms presents itself, to go behind the cord symptoms in an endeavor to determine the underlying condition. The blood should be carefully examined, the presence or absence of malignant disease determined, and debilitating conditions of whatsoever sort investigated. Should any underlying condition be found, the treatment should be directed toward it as well as toward the spinal cord symptoms themselves. If, however, as is not infrequently the case, no such etiologic factor can be found, the symptoms of ataxia and spasticity must be treated according to the general rules already laid down. It is advisable, particularly if the ataxia preponderate over the motor disturbances, to attempt the use of the Fränkel exercises. The frequent failure of this method of treatment is due to the involvement of the motor tracts and to the usual somewhat rapid course of the disease. The results are far less favorable than in tabes. Drugs, except such as maintain the general nutrition and regulate the bodily functions, are unavailing. Iodid of potassium, particularly, should not be used in this affection in the large dosage which is often employed where there is a suspicion of syphilis.

A true combined dorsal and lateral systemic disease is often difficult to distinguish clinically from the type just described, and its treatment must be directed toward meeting the symptoms as they arise. Massage, exercises, general hygiene, and a strict adherence to a definite plan of life will accomplish more than drugs.

FRIEDREICH'S DISEASE

The lesions in Friedreich's disease, or so-called hereditary ataxia, are of the combined spinal-cord type, and are usually such as to indicate a faulty development of the entire spinal cord, and possibly of other portions of the nervous system as well. The disease develops at or before puberty, is distinctly hereditary in type, and is characterized by incoördination of gait, resembling that of tabes combined with cerebellar ataxia. In the late stages paralyses in the form of paraplegia with contractures may develop, but the patients frequently live from twenty to forty years, or even longer, after the appearance of the disease.

Treatment.—The treatment of the disease, as of its allied condition, cerebellar ataxia, in view of its hereditary character and of our ignorance of its true etiology, is palliative merely. As in other slowly progressive and deforming diseases, something may be done by persistent mechanical treatment, and in the latest stages, when the contractures have led to club-foot or other serious deformities, surgical interference may bring relief of the symptoms.

The combined degenerations of the cord which frequently occur in dementia paralytica usually demand no special treatment in view of the far more serious cerebral condition.

DIFFUSE DISEASES OF THE SPINAL CORD

In distinction from the types of disease which we have considered under the general heading of systemic or quasi-systemic affections is a large group of diffuse diseases of the spinal cord which are in general characterized by no definite localization or predilection either for gray or white matter or for individual neurone systems. Such affections are further characterized by the fact that the destructive agent comes from without, often by way of the blood-vessels, rather than through an inherent weakness of the parenchyma itself.

ANEMIA

Anemic conditions of the spinal cord are no doubt more frequent than is ordinarily supposed, and are a somewhat constant accompaniment of a general failure of the blood-supply throughout the nervous system. If for any reason a spinal blood-vessel, through alterations in its wall, is no longer permeable, the natural results must follow and structural changes take place in the part of the cord supplied by that vessel. The imperfectly studied arteriosclerotic changes of the spinal arteries leave much to be desired in our knowledge of the exact alterations which take place. Except when the lesions produced are so extensive as to give rise to definite symptoms, the suspicion of spinal cord anemia is rarely entertained. In its milder forms it is significant only as a part of a more general condition, and its treatment requires no special mention.

Congestion of the spinal cord is of still less significance, except in those rare instances where we may conceive it as the forerunner of a hemorrhage into the cord substance. The general pressure in the arteries of the spinal cord is such that a congestion which would produce marked symptoms in the brain would lead to small effect in the spinal cord. The treatment, therefore, is rarely directed to congestion of the cord as such, but rather to the general underlying condition.

HEMORRHAGE

Hematorachis, or hemorrhage into the vertebral canal, and hematomyelia, or hemorrhage into the substance of the spinal cord, are, in approximately nine-tenths of all cases, due to trauma, either with or without fracture of the spinal column. Hemorrhage, both within and without the spinal cord, may naturally occur in the same case, but it is rather a striking fact that extra-medullary hemorrhage very frequently does not take place in consequence of violent injuries to the spine. The distribution of the blood-vessels is such that, other things being equal, the tendency to hematomyelia is far greater than to hematorachis. Hemorrhages in the spinal cord usually involve the gray matter, and frequently are limited to it, owing, no doubt, to its greater vascularity. For mechanical reasons such hemorrhages are apt to be tubular in character and may extend for long distances up and down the cord. Not infrequently also such a hemorrhage is found at a considerable distance from the point of injury, with normal intervening cord. More or less hemorrhage is inevitable in such fractures and dislocations of the spinal column as lead to local destruction of the spinal cord. In these severe injuries, however, the circumscribed destructive process gives rise to the predominant clinical picture. In those instances in which hemorrhage takes place without fracture or dislocation, as, for example, by striking the head in diving, the symptoms are somewhat less marked, and suspicion should always be aroused of hematomyelia. In predisposed individuals, such as those of arteriosclerotic tendencies or of a hemorrhagic diathesis, straining and lifting may lead to a like result. This is, however, exceedingly rare. If the hemorrhage is extra-medullary, symptoms of irritation, both motor and sensory, should lead to a suspicion of its locality.

Treatment.—Cases of injury of the spinal cord should not be operated upon indiscriminately. If the cord be completely destroyed at any level, operation must of necessity be unavailing. If there is evidence that destruction is not complete, and particularly if there be signs of hemorrhage into the vertebral canal, operation may justifiably be undertaken. In all cases a careful neurologic examination should precede surgical interference. (For a discussion of surgical treatment of these conditions see p. 835.) If there is evidence of hemorrhage and surgical interference is not undertaken, absolute rest is essential for a period of from two to three weeks in order to give the injured spinal cord the best possible opportunity for recovery. Hyperextension of the spine may be tentatively adopted in cases where there is a suspicion of displacement of the vertebral bodies through fracture or dislocation. The extreme frequency of this occurrence justifies a trial of hyperextension, with immobility of the spine in that position in many cases. In any such treatment, particularly if plaster be used, the utmost care must be taken to avoid decubitus, which naturally is most easily occasioned below the point of the lesion because of the sensory disorder. In spite of such care this serious and usually fatal complication is sooner or later in many cases unavoidable. The development of cystitis is also almost inevitable in severe destructive lesions of the spinal cord, although not invariably so, as shown by a remarkable case recently published by Hinsdale. The treatment of these conditions, should they occur, is naturally the same as in other diseases, and requires no detailed discussion here. Should the patient survive and through careful nursing escape the complication of cystitis and bedsores, a paralysis, both of sensation and motion, results, depend ing upon the extent of the original injury. Such conditions are not progressive, and demand mechanical treatment by massage and electricity. Some improvement may ultimately result as the conduction paths not wholly destroyed recover their function. Lesions in the thoracic or lumbar region are not inconsistent with an indefinite term of life, provided the nursing be adequate. The prognosis of lesions in the cervical region is naturally much graver.

EMBOLISM AND THROMBOSIS OF THE CORD

The same conditions which give rise to embolism and to thrombosis in other parts of the body may lead to a like disturbance in the cord. Embolism, except through the intervention of bacteria, is naturally exceedingly rare, on account of the mechanical conditions prevailing in the spinal cord blood-vessels. Thrombosis, on the other hand, is no doubt a somewhat frequent occurrence, resulting from a general arteriosclerosis, and leading, as in other organs, to areas of necrosis in the part supplied by the affected artery.

The condition of senile paraplegia, with difficulty to be placed in any other category, is probably due to such alterations in the course of the pyramidal tracts leading to their partial degeneration, with the resultant symptoms familiar in elderly persons. There is naturally, however, no assurance in such cases that the lesion lies in the cord, since disturbances in the course of the pyramidal tracts, from the cortex through the oblongata, might cause similar symptoms.

The treatment of this condition, as of embolism and thrombosis in general, must be directed toward the vascular system, as detailed in other sections of this book.

ACUTE MYELITIS

Few terms have been so misused as myelitis. In the present state of our knowledge it is undoubtedly desirable to limit its application to those conditions in which an acute inflammatory process may be demonstrated with a reasonable degree of assurance, leading to disintegration and softening of the spinal cord. If not further defined, what is ordinarily meant by a myelitis is an acute transverse lesion of the cord, more or less complete, largely limited to one area. In this group it is undesirable to consider the traumatisms which have already been discussed. In these the element of inflammation as a primary condition is wholly lacking, and the term myelitis may not, therefore, properly be attached to them. The causes of acute transverse lesion of the spinal cord are manifold, chiefly due to infections and intoxications, using those terms in the broad sense, with the vague predispositions induced by general injuries, cold, exposures of various sorts, and overexertion. For example, in one case carefully observed a perfectly well man was attacked by a complete transverse myelitis, from the effects of which he later died, incident to a violent exposure and wetting while working in a sewer. Such an exposure must, however, probably be looked upon merely as a predisposing cause. The onset of myelitis has been described after acute infectious diseases, in the puerperium, after gonorrhea, and in consequence of syphilis and tuberculosis. Various infectious agents have also been found postmortem, and myelitis has been experimentally produced by the injection of various organisms. The possibility of the production of myelitis through simple intoxications must also be admitted. In general, the destructive agent, however varied in character, comes from without the nervous system itself through the blood-vessels. The pathologic anatomy of the condition, as histologically studied, is an acute softening. The cord is reduced in consistency, the outlines of the gray matter are lost, and the affected area is filled with the products of disintegration—myelin droplets, fat-granule cells, and inflammatory exudate. The inflammatory element is, however, usually masked by the extensive secondary softening.

The symptomatology is that of interruption of sensory and motor tracts. The areas of disturbance of sensibility and motility lie below the point of the lesion, and are naturally dependent upon the degree of destruction. The sphincters are also affected, and, although the disease is not progressive, it leads to grave disturbances and danger to life through the tendency to bedsores, cystitis, and their complications.

INCOMPLETE AND DISSEMINATED MYELITIS—ENCEPHALOMYELITIS

There is much evidence at hand to show that a true myelitis may occur in other forms than transverse. Disseminated myelitic foci have, for example, been described scattered indiscriminately throughout the nervous system. A type which also deserves mention is that which involves the cord secondarily to the membranes. Such an acute or subacute process may develop as a result of an active tertiary syphilis. The condition of encephalomyelitis, in which both brain and cord are involved in a similar manner, is also not uncommon. In general, it appears that infectious agents capable of producing inflammation may invade various portions of the nervous system, both gray and white, leading to symptoms naturally dependent upon the part of the nervous system involved. The important therapeutic consideration is a clear recognition of the possibility of such wide-spread inflammation in the nervous system, dependent oftentimes upon inflammatory processes elsewhere in the body. A slight hope for prophylaxis is hereby held out.

The justifiability of the use of the term chronic myelitis may be questioned. The progressive form of spinal cord involvement, which presents on the clinical side evidence of more or less complete transverse lesion of the cord, may, for purposes of convenience, be termed chronic progressive myelitis. The term, however, may well be limited only to those conditions of more or less acute onset, but of prolonged course. The term chronic myelitis, as suggestive of a process which is essentially progressive, is undesirable and unnecessary, and on the pathologic side inexact.

The prognosis of these varying conditions cannot at the outset be definitely determined. Improvement is probable, as in poliomyelitis; a somewhat stationary condition is usual; an apparent progress is possible through secondary degenerations or through a repetition of the original acute inflammatory conditions. In those cases following infections in which the symptoms are essentially an acute ataxia, the prognosis is good. Likewise those forms which result from syphilis are favorable in outcome. The development of acute decubitus is always a most serious condition.

Treatment.—The serum treatment for myelitis in its various forms is as yet elusive, and cannot demand attention from the practical standpoint. As in many other destructive lesions, we are forced back upon a largely symptomatic treatment. Rest is imperative in the acute cases as a means of aiding a restitution of function in those parts not entirely destroyed. Diaphoresis and counterirritation have a limited application in the early stages. The salicylates may be given, and iodid of potassium is demanded in those cases in which syphilis is suspected. Warm baths are desirable, and the usual precautions regarding the avoidance of decubitus are imperative. Water- or air-pillows are useful to avoid local pressure. The catheter must naturally be used with the greatest possible care, and unremitting attention given to the absolute cleanliness of the person. A symptom of great annoyance and discomfort is the tendency to painful spasm and contracture of the muscles. Warmth is the best means of combating this disturbance, and in intractable cases a permanent warm bath lasting several hours may be used with advantage. Electricity is rarely indicated in these cases, in which spasticity predominates over atrophy, since positive harm may be done by increasing the spasm. The usual massage and gymnastics may be applied with advantage in long-continued cases, to meet the needs of individual patients.

AFFECTIONS OF THE SPINAL CORD DUE TO PRESSURE

Any condition which leads to sufficiently prolonged and extensive pressure on the spinal cord will ultimately produce the symptoms of myelitis. The term pressure myelitis has, therefore, erroneously been applied to these conditions. For the sake of accuracy it is desirable to speak of such affections as compression paralyses, leaving out entirely the misleading term myelitis, in spite of the fact that a certain degree of secondary inflammation may ultimately result, even though the original source of disturbance be non-inflammatory in character.

SPONDYLITIS

Spondylitis, especially in the form of Pott's disease, is a common cause of pressure on the spinal cord. The process ordinarily begins in a vertebra, which it gradually disintegrates, leading to a kyphosis. The bending of the spinal column of necessity leads to distortion of the spinal canal. The cord, however, lying free in the canal, ordinarily does not suffer from immediate compression to any great extent. The tuberculous material, escaping into the canal extradurally, leads gradually, however, to compression. If the process is not checked, the dura is finally eroded and the cord itself is involved. This leads to meningeal thickening and to secondary alterations in the cord of a quasi-inflammatory sort. The symptomatology, dependent, as always, upon the height of the lesion, is determined by the amount of pressure or destruction of the spinal cord. Spasticity with exaggerated deep reflexes is the predominant sign, later associated with sensory disorders and sphincteric disturbances.

Treatment.—It is unnecessary at this place to consider the treatment of Pott's disease as such. This is essentially a surgical matter, and comes within the province of the orthopedist. It is, however, extremely important for the physician to recognize the first signs of Pott's disease, as indicated not only by spinal deformity, but also through the symptoms on the part of the nervous system. There are few affections in which immediate treatment is more essential than in this. Even well-developed signs of pressure may be quickly and easily relieved by proper fixation of the spine, if the cord be not already injured. On the other hand, if the process is allowed to progress to the stage of cord destruction, treatment can at best be palliative and not curative. The general treatment of the disease, therefore, resolves itself into a correction of deformities which may have developed and into an effort to check the tuberculous process by medicinal and other means. To this end the general health of the patient, usually a child, must be most carefully regarded. He must be put under those conditions which are now recognized as essential in the treatment of tuberculous processes in general. The recent provision which has been made in several cities for the establishment of sanatoria for the care of patients suffering from bone tuberculosis is a step in this direction. What has elsewhere been said in relation to tuberculosis applies absolutely to the condition under consideration. The treatment is primarily prophylactic, and, secondarily, curative. The spinal cord symptoms are to be treated, as already suggested, under the general heading of Myelitis. Operation on the cord at the level of the disease has been advocated and practised. It offers some hope of amelioration through removal of the tuberculous mass. Its necessity, however, is now, fortunately, rare. Treatment of spondylitis due to Pott's disease in the adult is to be carried out on the same principles as in the child. Special care should be taken in the adult, however, to examine for cord symptoms, inasmuch as kyphosis is a far less prominent sign than in the child.

The various forms of spondylitis due to rheumatoid affections are coming to deserve attention when viewed from the standpoint of the nervous system. The work of Goldthwait* on the results of hypertrophic arthritis, particularly of the vertebral column, goes to show that nerve symptoms of a definite sort may be produced thereby. Before reaching a definite conclusion as to the source of pain and atrophy in localized areas, a careful examination of the spine should be made to determine its mobility and the pain reactions which are produced by its movements. The symptoms in these cases are presumably produced by pressure, and are ordinarily benefited by the relief of that pressure through immobilization.

VERTEBRAL TUMORS

A further prolific cause of symptoms, simulating a true myelitis, is the presence of vertebral tumors with secondary pressure on the cord. Such tumors are usually carcinomatous in type and metastatic. The physical conditions resulting from a destructive tumor of the vertebræ are analogous to those seen in Pott's disease, with the exception that pain is a much more conspicuous feature. Inasmuch as these tumors are almost invariably metastatic and occur toward the end of life, their treatment is doubly hopeless. Operation is rarely advisable, and medicinal treatment, except such as may be directed toward the general malignant condition or toward the relief of individual symptoms, is unavailing.

INTRAVERTEBRAL TUMORS

A far more important condition from the practical, and especially from the therapeutic, standpoint is the group of intravertebral tumors. These tumors, originating frequently from the membranes of the cord, are often benign and encapsulated. They very frequently involve the cord in no other way than through pressure, and their removal, therefore, means cure, provided the cord be not too seriously damaged before their removal is undertaken. Syphilis may occasionally give rise to a localized gummatous deposit which has all the significance of a tumor, but this is unusual in the absence of other and more general symptoms of the disease. Sarcomas, psammomas, tubercles, fibromas, myxomas, and other varieties of tumor have been described as occurring about the cord. Multiple tumors are also not infrequent, and naturally complicate the surgical treatment.

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* Goldthwait: "Osteo-arthritis of the Spine; Spondylitis Deformans," Boston Med. and Surg. Jour., cxlvi, 299, 1902; also, "The Differential Diagnosis and Treatment of the So-called Rheumatoid Diseases," *idem*, cli, 529, 1904.

The symptomatology of intravertebral tumors is naturally dependent upon their location. Pain is rarely absent as a symptom, and is one of the most important diagnostic factors. It may, however, in rare cases be inconspicuous or absent.

Treatment.—Apart from a vigorous anti-syphilitic treatment, when the slightest suspicion of syphilis is secured, practically nothing is to be done by medicinal means. Arsenic may be given a trial, but if the diagnosis of an intravertebral tumor be made with any degree of certainty, immediate operative interference is imperatively demanded. Delay is often fatal to the integrity of the spinal cord through the growth of the tumor and the increasing results of pressure, and at best the recovery of the cord from pressure of relatively short duration is a tedious matter. The relative success of surgical interference in this condition is a further justification for an immediate attempt to remove the growth.

TUMORS OF THE CORD ITSELF

Tumors of the cord itself occur not infrequently in the form of a gliosis, considered somewhat more in detail in the next section. Gummatous deposits and occasionally solitary tubercles appear in the substance of the cord, and malignant metastases are not infrequent. In these cases surgical intervention is rarely to be considered, and our methods of treatment resolve themselves into those of a general sort and those designed to meet symptomatic indications. These have been sufficiently detailed in the foregoing sections.

DISEASES OF THE CONUS TERMINALIS AND OF THE CAUDA EQUINA

The lower portion of the spinal cord, with its longitudinally running nerve-roots, constituting the cauda equina, have importance from a medical standpoint, not only because of the relative frequency with which they are injured or diseased, but also because of the greater success of surgical interference in this part of the vertebral canal than in regions higher up. The usual type of lesion which the physician is called upon to treat is due to trauma from fracture or dislocation of lumbar vertebræ, from wounds and hemorrhages. Tumors may also occur here as elsewhere in the vertebral canal, and the products of syphilis may also lead to lesions in this region. A possible though extremely slight source of injury to the nerves of the cauda equina has recently been introduced by the general adoption of lumbar puncture as a diagnostic or therapeutic measure.

Treatment.—Apart from the use of the anti-syphilitic remedies in all suspected cases, and such care as the individual case requires regarding the relief of pain, the prevention of bedsores, and the general relief of symptoms, the treatment is essentially surgical.

SYRINGOMYELIA

The disease, syringomyelia, is not to be sharply distinguished from a simple gliosis of the cord characterized by a proliferation of neuroglia. A syringomyelia begins as such a localized gliosis, which, extending usually in a longitudinal direction, finally, through deficiency of blood-supply or other cause, breaks down at its center, producing a cavity surrounded by a rim of proliferated neuroglia of varying thickness. The cause of this disease is presumably to be sought in congenital defect. It occurs in the young or in young adults, and is clinically characterized by sensory disturbances, usually beginning in the arms, of the dissociated type. The contact sense is retained, whereas the capacity to recognize temperature and pain is lost or blunted. The explanation of this phenomenon is to be sought in the location of the process, usually in the cervical region, and interrupting those fibers which conduct the sensations of pain and temperature, whereas those subserving contact are in great measure uninvolved. The muscular atrophy of this disease is due to an invasion of the ventral horns, with destruction of nerve-cells. The course is slowly but inevitably progressive.

Treatment.—The treatment, unfortunately, is merely palliative. Pain is a rare accompaniment, hence the task of the physician is easier. We have absolutely no means of checking the progress of the growth, but the care of such patients is nevertheless not wholly thankless. The rules regarding overuse of the muscles affected should be strictly enforced, together with such general mechanical therapeutic measures as are designed to meet the defects of atrophy and contracture. Particularly important is the warning that patients should take the utmost care to avoid excesses of heat and cold. Owing to the defect of this type of sensibility, burns of a serious sort frequently result, leading to sores which are slow in healing. Much discomfort may be avoided by a simple insistence upon this one point. The tendency to the formation of trophic sores in general is not to be controlled. Their treatment when formed is protective, with as complete surgical cleanliness as may be attained.

SYPHILITIC SPINAL PARALYSIS (Erb)

Erb has described a form of syphilitic disease of the nervous system characterized by a gradual onset of spastic paresis of the legs, with increased tendon reflexes, involvement of the bladder, slight but definite disturbances of sensibility, of chronic course, with a tendency to improvement, remissions, and at times stationary. The lower thoracic cord is usually the seat of the lesion. The sharp separation of this condition from general cerebrospinal syphilis is, however, not completely justified by the facts. It is often accompanied by cerebral symptoms, and it is, no doubt, best to regard it as marking a special stage in a more general infection rather than as a characteristic pathologic entity. It has the clinical significance of an incomplete myelitis, and on the pathologic side is characterized by a somewhat localized syphilitic thickening of the meninges, with subsequent or accompanying infiltration of the spinal cord.

Treatment.—The treatment is that of syphilis in general as applied to the nervous system. The patient should be subjected to a vigorous administration of iodid of potassium and mercury until a definite improvement in the signs and symptoms results. In spite of apparent continued improvement after the cessation of treatment, it should be repeated at least once or twice a year for an indefinite period. The general condition of the patient should be maintained by baths, massage, and the usual measures. If taken before serious injury to the cord has resulted, the outcome of treatment is usually encouraging and often strikingly satisfactory; if, on the other hand, a permanent degeneration of the pyramidal or other tracts has taken place, the restoration of function cannot be complete. As in all forms of cerebrospinal syphilis, treatment should be begun at the earliest possible moment and prosecuted with vigor and perseverance.

Other forms which syphilis of the spinal cord may assume have been referred to in various places in the foregoing pages. In general it appears as a meningeal involvement, but the attempt to separate it sharply from the cerebral varieties is unjustified.

ACUTE ASCENDING (LANDRY'S) PARALYSIS

As a clinical condition so-called Landry's paralysis has a certain claim to recognition as a distinct disease. Recent investigations have shown that the lesions inducing the symptoms are so varied in character that a disease entity in any strict sense of the word is no longer to be considered. The pathologic changes described have varied all the way from slight cellular degenerations occurring in the ventral horns up to violent inflammatory processes of the nature of a poliomyelitis and various alterations in the peripheral nerves. Cases are still described also in which no lesions are discoverable, as originally maintained by Landry. The clinical aspects of the disease are much more characteristic, however, consisting in an ascending paralysis of the motor type, with slight sensory involvement, and ushered in by an acute febrile attack. The analogy to poliomyelitis is evident, and in the light of our recent knowledge there is small doubt that a very large proportion of the cases formerly described as Landry's paralysis were in reality adult poliomyelitis. There is at least no question that transitional forms exist between it and poliomyelitis, on the one hand, and myelitis or peripheral neuritis, on the other; so that, except from the purely practical standpoint, the affection usually permits of analysis into one or another of these conditions.

Treatment.—The treatment is the same as that for other processes of an acute or subacute febrile onset. Absolute rest in bed and careful regulation of the diet and the bowels should be enforced. The cord process itself, whatever its exact nature may be, cannot be checked by any means at our disposal. Its progress is usually uninterrupted until the oblongata is reached, when death ensues. In other cases recovery takes place after a longer or shorter interval, but in either instance the efforts of the physician are unavailing, and will remain so until some definite means be found of neutralizing the infectious agent.

MULTIPLE SCLEROSIS

Multiple sclerosis is a more frequent disease in this country than is ordinarily supposed. It is frequently not diagnosticated correctly, and oftentimes escapes diagnosis entirely. Its symptomatology is most varied, and as our knowledge of the disease progresses, the so-called cardinal signs of intention tremor, scanning speech, and nystagmus are coming to assume a less and less important place. The search for these symptoms and the failure to find them have often led to errors in diagnosis. A spastic paraplegia is an important, though naturally far from being a pathognomonic, sign, and various ocular changes are no doubt of much significance. On the pathologic side the disease occupies a unique position. The lesions are multiple gliomatous patches scattered indiscriminately throughout the brain and spinal cord. In spite of the apparent extent of the destructive process, the axones are in great measure spared, as well as the nerve-cells. The myelin, however, shows a peculiar tendency to disintegration. Except for the possibility that the disease has some relation to antecedent infectious processes, or possibly to congenital defect, the etiology is absolutely vague. The affection is insidious in onset, chronic in course, with occasional long remissions, and absolutely fatal in outcome.

Treatment.—Treatment is unavailing; even the mechanical methods, useful in various other conditions, help but slightly here. The tremor, when marked, is not amenable to treatment either by drugs or exercises. Fortunately, the disease is disabling merely and never painful, nor distressing as regards the function of any of the internal organs. Although unable to move voluntarily without violent contortions which render muscular rest imperative, the patients in the later stages frequently express themselves as feeling perfectly well in every respect. The mind occasionally becomes affected, and more or less euphoria is common, but commitment to a special hospital is rarely required. The symptoms which arise in this, as in the course of any disease of protracted character, demand the constant attention of the physician and nurse. Their treatment, however, is not different from that suggested for other affections.

CAISSON DISEASE

The importance of caisson disease is apparently increasing with the development of engineering. It has been found that persons working under compressed air in tunnels and places of that character may, on reaching air of lower pressure, suffer from acute symptoms on the part of the nervous system characterized by vague motor and sensory disturbances, with vertigo and muscular weakness. The production of these symptoms is attributed to small areas of softening induced by alterations in the circulation, and possibly due to minute air emboli.

The disturbances arising in rarefied air, as experienced by mountain climbers, is interesting in this connection, and in general indicate the desirability of equable air-pressure.

The treatment of caisson disease is primarily prophylactic. Special care should be taken by those working under compressed air that a gradual transition to air under normal pressure should be made. This may naturally easily be accomplished by care, particularly if those having workmen in charge are made to realize the possible dangers. The treatment of the condition when developed is purely symptomatic, and recovery is the rule, though defects at times remain and fatalities occasionally occur.

DISEASES OF THE SPINAL NERVES

By E. W. Taylor, M.D.

In considering the affections of the spinal nerves it is important to recognize the fact that they are anatomically distinguished from nerves of the central nervous system by having a connective-tissue sheath—the so-called sheath of Schwann. The power of regeneration of peripheral nerves is very great, in marked contrast to the central nerves, where no such power of regeneration exists, or at least to a negligible degree. Inasmuch as the only histologic difference lies in the presence of a connective-tissue sheath in the peripheral nerve and its absence in the central nerve, the assumption is a natural one that this connective-tissue sheath is instrumental in promoting regeneration. An important piece of work has recently been done on this subject by Ballance and Stewart, who believe they have shown, both histologically and experimentally, that the impetus of regeneration lies essentially in the cells of this connective-tissue sheath, and only in small part in the cells of origin of the affected nerve-fibers. They furthermore maintain that their investigations have disproved the neurone theory. A discussion of this mooted subject does not at present concern us, but it may be said that stronger proof than is as yet forthcoming must be adduced before the theory of central regeneration can be definitely refuted. The theoretic significance of this matter, especially on the surgical side, is very considerable, although it cannot in any great measure affect surgical practice. The matter of importance for us is that, through some mechanism as yet imperfectly understood, injured peripheral nerves regenerate, whereas central nerves do not, and that the treatment of peripheral affections thereby becomes one of the most hopeful instead of one of the most discouraging therapeutic fields.

General Symptomatology.—Inasmuch as the peripheral nerves, with the exception of certain of the cranial nerves, are both motor and sensory, it follows that their lesions bring about disturbances both of motion and of sensation. The interruption of the motor fibers naturally leads to a flaccid condition of the muscles supplied, with atrophy and accompanying electric alterations. Interruption of the sensory fibers, or their irritation, leads to disorders of sensibility of the most varied type, from excessive pain to slight disturbances of the cutaneous sensibility. Trophic disorders are also frequent in the more serious types of disease of the peripheral nerves, and usually, when neuritis is present, there is sensitiveness upon deep pressure along the course of the affected nerves. The importance of sharply distinguishing peripheral from central lesions is evident, not only from the point of view of treatment, but especially because of the very different prognosis in the two cases. The clinical distinction may be more definitely maintained, however, than the anatomic one, since undoubtedly affections of the peripheral nerves and of the cord substance are not infrequently coincident.

General Principles of Treatment.—As already indicated, the treatment of affections of peripheral nerves is always encouraging. The natural power of regeneration is so great, and the artificial means which may be brought to nature's assistance are so efficacious, that there is, in a great majority of cases, assurance of definite improvement and often of practical cure. Whether the treatment be surgical or by means of less radical measures, it is evident that its success depends upon assisting the vigorous efforts which the organism is itself making toward the restoration of function. The treatment is often tedious and frequently temporarily discouraging, but should not on this account be given up until it is definitely established that the lesion has extended beyond the peripheral portion of the nerve into the substance of the cord itself. In these cases complete recovery does not occur. In general, the treatment must be directed first toward the symptom of pain; and, secondarily, toward a restoration of the degenerated muscles, best accomplished by the systematic use of massage, electricity, bathing, and such drugs as tend to promote the general strength. Surgery also plays a most important part in the therapeutics of peripheral nerves, both because of the regenerative capacity of this portion of the nervous system and also because of the relative frequency with which the peripheral nerves are injured.

For the sake of convenience in classification it is desirable to consider the affections of the peripheral nerves under the three general headings of: (I) Traumatism; (II) neuritis; (III) neuralgia.

TRAUMATISM

Injuries to peripheral nerves are naturally extremely frequent, from their relatively exposed position. A severe accident of almost any sort, involving a cutting or laceration of the soft tissues, is likely to produce a more or less definite injury either to a nerve-trunk or to its branches. A nerve may be actually severed, with retraction of its ends, or, as often happens, it may be crushed or bruised in such a way as to give rise to a partial loss of function. The symptoms depend upon the degree of actual nerve injury, and in the less severe cases it is onticeable that the sensibility is less affected than the motility, owing, no doubt, to the greater natural resistance of the sensory fibers, as seen also in disturbances of other sorts. The prognosis depends upon the degree of injury and the possibility of restoration of nerve continuity. If, for example, connective tissue forms about the nerve at the point of injury, or if a callus or other obstruction prevents the natural restitution of the injured nerve, recovery in the absence of surgical treatment is seriously interfered with. In this connection the development of a reaction of degeneration is important. Should the nerve show no sign of this reaction two or three weeks after the receipt of the injury, an uneventful recovery may, as a rule, be expected. If, on the contrary, a reaction of degeneration is present, consisting of a loss of faradic irritability, both from the nerve and from the muscles supplied by it, and also a loss of galvanic irritability from the nerve, with an increased irritability in the muscles, the contraction being slow and the cathodal closing contraction losing its preponderance over the anodal closing contraction, the likelihood of speedy recovery is very greatly diminished, even if other conditions are favorable. In those injuries of peripheral nerves in which surgical intervention is not called for the nerves should be treated by rest, to prevent an extension of possible inflammation. To accomplish this end the part affected may be confined by splints, great care being taken, however, not to interfere with the circulation, or to bring undue pressure to bear upon the nerve affected or others in its neighborhood. When the acute stage and the immediate effect of the injury in the way of exudate or possible hemorrhage have passed, the nerve should be treated by the ordinary methods of electricity and massage, which will receive further discussion in connection with the treatment of neuritis.

Surgical treatment of nerve injuries is exceedingly important. In all cases in which there is evidence of callus formation or other interference with the continuity of the nerve, surgical treatment should be seriously considered. There are few procedures which offer more brilliant results than this in the hands of a skilled operator.

NEURITIS

The term neuritis as ordinarily used is, unfortunately, far more comprehensive than the facts of pathologic anatomy justify. Under this head are included a great variety of disorders of the peripheral nerves, many of which have no relationship to inflammation, as that word is generally understood. The distinction of a perineuritis, an interstitial neuritis, and a parenchymatous neuritis has been made to overcome the confusion in classification. Of these the peri- and interstitial forms are, properly speaking, inflammatory, inasmuch as the irritative agent which leads to the secondary alterations in the nerve is derived from the blood-vessels and is accompanied by the classic symptoms of pain, heat, redness, and swelling. The nerves themselves are secondarily involved through the presence of the exudate in their sheaths or in their immediate neighborhood. Such a process is properly termed a neuritis, and from the standpoint of pathologic anatomy should alone be so called. The term parenchymatous neuritis is a misnomer, inasmuch as the elements of inflammation as ordinarily understood are lacking. The lesion in this case consists in a degeneration of the nerve-fiber as such, irrespective of its sheath or its blood-vessels, except in an indirect way. This condition, which is far more common than true neuritis, has also been known as degenerative neuritis. Provided the pathologic distinction between the two varieties be kept sharply in mind, there is no objection, on the clinical side, to continuing the use of the term. It is furthermore to be said that oftentimes sharp distinction between a parenchymatous nerve degeneration and an interstitial process is not to be made, and that the two are frequently combined. It is clear that an interstitial process sufficiently long continued may lead to a myelin and axone degeneration which in itself is not to be distinguished from a primary degeneration of the nerve-fiber itself. For practical purposes, however, it is important to bear in mind that there may be distinct inflammatory processes occurring in and about nerves, and also that much more commonly there may be primary degenerative conditions, either independent of, or associated in some degree with, true inflammations. A slight form of nerve degeneration has been described by Gombault in which the myelin alone suffers, sparing the axone. This, no doubt, is to be regarded as a difference in degree rather than in kind of degeneration.

The histologic alterations which constitute nerve degeneration, whether or not associated with inflammation, are, essentially, fragmentation of the myelin, later destruction of the axone, with proliferation of the cells of the connective-tissue sheaths. In any well-marked variety of neuritis, using the word in its broad sense, such alterations take place. Without entering upon a discussion of disputed points, recovery takes place through a gradual restitution of the axones and the myelin sheaths, with an accompanying capacity of transmission of nerve impulses.

Etiology.—The causes of neuritis are manifold. Traumatism has already been considered. Injuries to nerves naturally lead to secondary degenerations below the point of the injury, and in certain cases an apparent true inflammation is set up, even although there is no evident means of invasion of pathogenic bacteria. It must be conceded, therefore, that traumatism, under certain conditions, is sufficient to place the nerve in such a state that irritative agents, otherwise incapable of producing inflammation, may lead to this result. If the wound be an open one, and particularly if it be septic, a neuritis may be set up by direct action of infective agents. Less severe injuries also, such as the results of contusions or compressions, may likewise arouse a neuritis, using that term in its comprehensive sense. Dislocations, tumors, or pressure from any other cause, may lead to a like result when the nerve is directly involved. A difficult condition to interpret, but one which may at times have the appearance of a neuritis, is that due primarily to the overuse of certain groups of muscles, known commonly as professional neurosis.

Various chemical agents are capable of producing a definite neuritis. Of these, ether is the best example. This fact is also of importance on account of the use of ether subcutaneously. Neuritis also frequently follows infectious diseases, or conditions in which infective agents are present in other portions of the body. Typhoid fever, diphtheria, tuberculosis, syphilis, and conditions arising during the puerperium may all give rise to nerve alterations, usually of the polyneuritic type. Chronic intoxications are a prolific cause of a subsequent neuritis.

Of these, alcohol easily occupies first place, both because of its frequent abuse and the ease with which it produces degenerative and inflammatory conditions in the peripheral nerves. The metallic poisons, of which lead is an example, are apt to lead to degenerative changes of the parenchymatous type. Constitutional diseases, such as rheumatism, gout, diabetes, leukemia, arteriosclerotic conditions, the carcinoma cachexia, all predispose the nervous system to an outbreak of neuritis. In general, it may with justice be said that any disorder which leads to a depreciation of the vital forces of the organism is capable of producing nerve alterations which may be included under the general head of neuritis. The question of bodily nutrition, quite apart from any distinct, exciting cause, is always an important factor in the production of a neuritis. Granting a depraved condition of nutrition, the causes which we have mentioned naturally have a favorable field in which to develop. The investigations of the past few years have shown conclusively that the former much-talked-of etiologic factors of cold and exposure have been very much overrated. It is not to be denied, however, that such influences may so far lower the resistance that other factors may come into play more readily to produce varying degrees of neuritis.

From the clinical standpoint the distinction between neuritis of a single nerve and neuritis of several or many nerves is important. The latter condition is known as polyneuritis, and is usually due to general causes acting on the nervous system as a whole, such as alcohol, lead, arsenic, or the toxin of diphtheria. Neuritis of single nerves, on the other hand, is usually due to local causes, such as have been mentioned under the various traumatisms.

Course.—The course of any given case of neuritis is naturally dependent upon many factors, and particularly upon its cause. If the cause be local, such as injury to a nerve, the prognosis is in general good; if, on the other hand, the cause be due to an underlying cachexia which cannot be relieved, the nerve degeneration depends for its improvement upon the progress of the causative affection. If the immediate cause of the neuritis,—as, for example, alcohol,—can be completely removed, the outcome is usually favorable and progress toward recovery often rapid, even after extreme degrees of paralysis. A reduction of sugar in cases of diabetes frequently tends to very marked improvement of accompanying neuromuscular degenerations.

Treatment.—There are few conditions in which a painstaking investigation of the entire body is more necessary if the treatment is to be rationally carried out. The possible causes of neuritis are, however, so numerous and often so subtle in their action that a thorough search is often incapable of discovering the essential etiologic factors. The rational treatment demands that the cause, if it can be found, be removed. For example, if lead-poisoning or alcoholism or general malnutrition or possibly a blood disease be the source of the secondary neuritic symptoms, it must be treated primarily. This often results in brilliant success. In those instances, and they are naturally very numerous, in which no etiologic factor can be discovered, the affection must be treated symptomatically, and much may thereby be accomplished. The general condition of the patient should always be regarded. He should be given a plain and absolutely nutritious diet, the bowels kept freely open, and the daily routine carefully regulated. In the early and more acute stage quiet, and often absolute rest, is essential. Diaphoresis, the local applications of cold, or the use of a cool pack, and also warmth, are all indicated as palliative measures. If the process be primarily febrile and associated with the development of a true inflammatory condition of the nerves, every means should be taken to guard against a spread of the inflammation, and precisely the same rules as applied to the treatment of inflammation in general have application here. The situation is often made decidedly worse in this type of neuritis by use of the affected nerves and muscles. On the other hand, in those cases of parenchymatous degeneration in which the element of pain and tenderness is lacking, a more vigorous treatment may be instituted from the outset, directed toward an improvement in the nutrition of the muscles supplied by the affected nerves. If the exact cause of a neuritis cannot be determined, it is essential to intelligent treatment that true inflammations should be distinguished from primary degenerative conditions. This may usually be done by the presence of pain and tenderness in the former case, and the existence of early muscular atrophy in the latter. The pain and discomfort of an acute neuritis must be met by the pain-stilling drugs. Of these, the most useful are the coal-tar products and the salicylates. Of the latter, aspirin in 10-grain doses three or four times a day deserves a high place. If syphilis be suspected, the usual recourse must be taken to iodid of potash and mercury. The opium preparations are frequently necessitated, and in this, as in other conditions, morphin subcutaneously is usually the best form of administration. If the process shows signs of chronicity, morphin should naturally be used with the utmost caution, and may, in fact, usually be dispensed with. In the acute stages faradism should not be used on account of its irritating properties. Galvanism, on the other hand, may be employed if great care is used not to increase the current strength beyond 4 to 5 milliampères, nor to make or break the current, and to apply the positive pole over the painful spot. In the later stages of interstitial neuritis, when the inflammation itself has subsided, and the nerve degeneration, with its effects, alone remains to be treated, and in the primary degenerative conditions, a much more active treatment should be instituted. We have no means of hastening the actual regeneration of a nerve, but a vigorous treatment of the muscular system is demanded to help in a restoration of the muscular volume, to improve the general circulation, and to overcome the tendency to paralytic contractures. The accompanying disorders of sensibility, except as manifested by actual pain, cannot be directly treated. The means used to overcome the later effects of a neuritis are mechanical, and consist essentially in the use of baths, massage with exercises, and the continued use of electricity. With the large share of assistance which nature gives, these means are efficacious. Electricity should be used to excite muscular contraction, care being taken not to overtire the muscles being treated. If the muscles respond to the faradic current, this should be used; if not, the galvanic current should be employed, using the pole for active stimulation, to which the muscles best respond. Massage in skilled hands is an adjuvant of very great and often underestimated value. Massage in these and in all cases should be given by a skilled person who has considerable knowledge of anatomy and who understands thoroughly the manipulations of his art. Passive movements should be an important part of the treatment where the tendency to contracture exists. The treatment is often tedious, but the ultimate outcome, unless the neuritis be due to an underlying incurable condition, is hopeful, even after months or years of illness. Should secondary contractures develop in spite of all efforts recourse should be had to surgery.

NEURALGIA

In our ignorance of its exact significance neuralgia is the term applied to paroxysmal pain occurring in nerves without a discoverable anatomic substratum. It is, in other words, a symptom rather than an understood disease. The pain is severe, at times unbearable, and is always characterized by remissions. The nerve affected is not generally sensitive to pressure, as in neuritis, but often shows certain distinct, painful points. On the clinical side neuralgia and neuritis are no doubt at times confused. A true neuralgia is rare in childhood, and is distinctly an affection of middle and advancing years. Men are more frequently affected than women, according to Bernhardt.

Etiology.—The causes of neuralgia are presumably numerous, as in neuritis. A so-called neuropathic disposition has been blamed probably beyond its due. It appears established that exhausting diseases in general, through lowering resistance and interfering with general nutrition, frequently gives rise to neuralgic pain as its accompaniment or sequence. Anemic conditions, cachexias of various sorts, advancing years with their arteriosclerotic accompaniment, all constitute definite predispositions. Constipation, the toxic products in the blood occurring in infectious disease, and the general poisons of the nervous system, such as lead, alcohol, and arsenic, are all causative. Exposure to cold and overexertion of mind or body should be regarded with skepticism as factors of importance. In this connection it is well to recognize the existence of pain, which by no possibility can be attributed to physical conditions, and yet which often simulates closely true neuralgia. This so-called psychalgia is to be regarded as wholly dependent upon the mental state of the individual, and should be treated accordingly. A distinction between the two conditions is often extremely difficult, and demands careful analysis on the part of the physician.

Treatment.—The same general principles as already detailed in regard to the treatment of neuritis apply also to neuralgia. The underlying cause of the pain must be sought and rectified. It not infrequently happens that the improvement of the general condition of the patient results in a disappearance of localized neuralgic pain. On the other hand, it is a frequent experience that, although the presumable cause of pain is recognized, nothing fundamental can be done toward its amelioration. This applies particularly to the cases coming on in advancing years in which arteriosclerosis, and its resultant disturbances of circulation, are the cause of the neuralgia. As a general measure, attention to the bowel function is important. Large doses of castor oil repeated for several days or a week often relieve the situation in a remarkable manner. With due regard to the bowel function, iron preparations are often efficacious in relieving the situation by building up the general health. Of the other drugs, all have at one or another time been used which are in any way analgesic in their action. In those forms of neuralgia in which a more or less definite periodicity is observable, quinin often meets with success, a somewhat large dose being given shortly before the paroxysm of pain. The salicylates are useful here, as in neuritis, and morphin is a frequent ultimate resort. There is peculiar danger in giving morphin in these conditions, and the morphin habit has many times been established through its careless administration in cases of neuralgia or psychalgia. Pyramidon is a drug highly recommended by Oppenheim, and Dana and others have employed strychnin with success. A recent method of treatment, followed especially by the French and Italians, is the subarachnoid injection of weak cocain solutions. It is not likely, however, that this somewhat radical procedure will attain general recognition. Electricity is useful, using the anode over the painful nerve, and the actual cautery as a counterirritant at times gives relief. A change of climate may with reason be prescribed, and such other general measures as tend toward an improvement of the physical condition. Surgical interference has grown in popularity during the last few years. It is without doubt an altogether justified procedure in certain cases, and an earlier resort to it might well be undertaken. The injection of an 80 per cent. alcohol solution directly into the nerve-trunk, suggested by Pitres, Vaillard, and Schloesser,* has been extensively practised by Patrick and others in this country, particularly in cases of intractable trigeminal neuralgia, where other methods have failed and operation has been contraindicated. The procedure is somewhat painful, but certainly efficacious, for a time at least. It should not be undertaken by the inexperienced.

DISEASES OF SPECIAL NERVES

BRACHIAL PLEXUS

The importance of disease of the brachial plexus is naturally very great, inasmuch as through it the muscles and skin about the shoulder and of the arm, forearm, and hand are innervated. Although the plexus is anatomically protected under ordinary circumstances, it is frequently the seat of injury through direct violence or through pressure exerted by dislocation of the humerus. In cases of complete plexus paralysis the lesion is usually caused by violent traumatism, which either ruptures the nerves in the plexus or, in rare instances, actually tears the nerve-roots constituting the plexus from the spinal cord. A case comes to mind in which, following a violent wrench of the arm in a coasting accident, a complete brachial paralysis resulted. The symptoms of these complete lesions naturally involve both the motility and the sensibility of the entire arm and of the region of the shoulder.

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* Schloesser: Muench. med. Woch., April 30, 1907.

A less severe and frequent type of brachial paralysis is known as partial plexus paralysis, and was originally described by Erb. In this type the deltoid, biceps, brachialis anticus, and supinator longus are regularly involved. The supinator brevis and the infraspinatus are often involved, and the subscapular seldom. In these cases the lesion is presumably of the fifth and sixth cervical nerve or of the upper trunk of the brachial plexus. Traumatism is likewise the usual cause of this paralysis. It is presumable that the so-call obstetric paralyses are caused by stretching or pressure at this part of the plexus in the process of birth.

The lower plexus type of paralysis, as described by Klumpke, involves the eighth cervical and first thoracic nerves, and, therefore, implicates the small hand muscles with the flexors of the forearm.

The prognosis of these several forms of paralysis depends upon the extent of the original injury. The outcome in total plexus paralysis, which usually means a rupture of nerves, is bad. That of the upper arm type, particularly in the form of obstetric paralysis, is usually favorable, and at least always tends toward improvement. The same is true of the lower arm type. If the lesions are due to tumor formation, however, or to a progressively increasing cause, the prognosis is naturally modified.

Treatment.—The principles of treatment of injuries of the brachial plexus are naturally those to which we have already given attention. If there is evidence of a discontinuity of nerves, surgical intervention is demanded. In the case referred to above, of total brachial paralysis of both sensation and motion, a very considerable degree of improvement has been attained through the suturing of the damaged and interrupted nerves of the plexus. Apart from surgical measures, the usual means of maintaining the tone of the muscles and helping in the restoration of the neuromuscular system are indicated.

Both a neuritis and a neuralgia of the brachial plexus may occur, involving one or several branches of the plexus. The diagnosis of a neuritis is made on the basis of pain on pressure over the plexus, disturbed sensibility, and altered motility, whereas the diagnosis of a neuralgia is in general determined by the absence of other signs than pain. The general principles of treatment apply in these conditions.

PARALYSIS OF INDIVIDUAL ARM NERVES

The median, ulnar, musculospiral, and circumflex nerves are not infrequently the seat of individual disease. Of these, the musculospiral is most exposed to pressure, usually through faulty positions in sleep, and especially observed after alcoholic excess. The prognosis of this form of so-called pressure paralysis is in itself good, but is naturally modified if coincident with a general alcoholic neuritis. The treatment is total abstention from alcohol, together with the usual mechanical and supportive measures. Injuries to these nerves are frequent and should be treated from the surgical standpoint.

DORSAL NERVES

The most conspicuous affection of the dorsal nerves is intercostal neuralgia, due either to a cause as yet unknown, as in neuralgia in general, or to pressure through tumors in any part of the peripheral course of the nerve, or through the antecedent or subsequent disturbance produced by herpes zoster. The occurrence of intercostal neuralgia in connection with angina pectoris is also not infrequent. The cause of intercostal pain should always be most carefully sought, and its treatment based thereon. The special means at our disposal have already been discussed in considering the general subject. Surgical means must often be resorted to.

LUMBAR AND SACRAL NERVES

The lesions of the lumbar and sacral nerves and of the plexuses are much less common than similar disturbances of the brachial plexus. Disease of the vertebræ, in the form of hypertrophic arthritis, injuries of various sorts, and tumors growing in the pelvis or in the course of the nerves, naturally produces the same results here as elsewhere. The involvement of the branches of these plexuses in a general alcoholic neuritis is usual. From a practical standpoint, by all means the most important involvement of nerves of the lower extremities is that of the sciatic nerve, owing to its size, its wide area of distribution, and its liability to injury or inflammation. The condition of the sciatic nerve, ordinarily described as sciatica, is at times due to local pressure in the pelvis or in the course of the nerve, is often a true neuritis, and in other instances must be classified simply as a neuralgia. It may be involved throughout its entire course, pain, discomfort, and difficulty in locomotion being the striking symptoms.

Treatment.—The treatment of this condition often taxes the ingenuity and patience of the physician to the last degree. As in other inflammatory processes, if a neuritis can be demonstrated, absolute quiet, with complete rest of the affected extremity, is desirable. In the later stages electrotherapeutics, massage, bathing, and a treatment directed toward the cause of the disturbance should be instituted. Not infrequently, as Goldthwait's researches have shown, a stubborn sciatic pain may be relieved by immobilization of the lumbosacral vertebræ. If neuralgia is the predominant disturbance, the treatment must be modified to combat the pain by the general methods already indicated. In intractable cases stretching of the nerve has been resorted to, after exposure by surgical means. The success of this rather radical procedure, particularly in view of our oftentimes somewhat vague knowledge of the underlying pathologic condition, does not justify its universal employment.

COCCYGODYNIA

Persistent pain about the coccyx is a distressing symptom. An air-cushion often gives relief, and such drugs should be employed as are calculated to relieve pain. Surgical interference is, however, often demanded.

TUMORS IN AND ABOUT THE NERVES

Tumors which not infrequently occur in the course of nerves, or in their immediate neighborhood, leading to nerve symptoms, must be regarded from the surgical standpoint, except in so far as they may be of syphilitic character. If such a suspicion be aroused, a vigorous antisyphilitic treatment is indicated.

THE SURGICAL TREATMENT OF DISEASES OF THE SPINAL CORD

By John Homans, M.D.

INTRODUCTION

The modern surgical treatment of diseases of the spinal cord received its incentive during the last part of the last century from English and German neurologists. The fact that tumors of the cord were not merely a pathologic curiosity was demonstrated by Horsley in 1886 by a brilliant operation upon an intradural growth, and since then the curability, by surgical measures, of a number of pathologic conditions involving the cord has become increasingly evident.

Unfortunately, technical failures have marked our progress in this direction. The recent brilliant advances in cerebral surgery—advances brought about through painstaking, long-continued efforts by a few men specially trained in this branch of surgery; advances which have only been possible through a combination of improved surgical technic with the ever-increasing knowledge of the physiologist, anatomist, and neurologist—are only beginning to be paralleled in this almost equally important field. The many failures of operative interference with tumors and injury of the cord may be attributed, on the one hand, to efforts to cure the far-advanced cases, which, in any untried field, are the only ones available, and, on the other, to technical errors on the part of the surgeon, involving lethal sepsis and injury to the delicate cord and its roots. At the present time these failures are becoming fewer, though it must be acknowledged that the treatment of vertebral injury, in so far as it involves the cord, has failed to keep pace with other branches of general or neurologic surgery.

The same may be said to be true of spina bifida, one of the commonest and most distressing of the congenital malformations. As Cushing has pointed out, our failure to advance the treatment of spina bifida, and of its partner, hydrocephalus, is due to a lack of knowledge of the etiology of the conditions involved in the disturbances of the circulation of the cerebrospinal fluid. The treatment of this condition is, therefore, limited to the mere closure of the spinal defect. It is frequently ineffective because it fails to get at the fundamental difficulty, which is presumably associated with the overproduction, or failure of proper disposal, of the cerebrospinal fluid itself.

Again, in infections of the vertebral canal, whether tubercular or not, there are undoubted possibilities of surgical treatment still comparatively untried. Localized serous meningitis, though its origin is still obscure, offers brilliant opportunities for treatment, and is one of the most curable of intraspinal lesions. Recently Cushing has pointed to the advisability of draining the lateral ventricles in the obstructive hydrocephalus of tuberculous as well as meningococcus meningitis, and though this carries us into the domain of cerebral surgery, it must be considered in the treatment of spinal cord disease.

Finally, a class of cases which has hitherto come within the domain of orthopedic surgery, the spastic conditions due to high interference with the upper motor neurones, as in Little's disease, has been attacked by intraspinal division of the posterior nerve-roots. The division of a number of nerve-roots corresponding to the segmental distribution of the motor and sensory nerves supplying the spastic muscle groups has a sound physiologic basis, though it does not appear at the present time that it is more than a valuable adjunct to orthopedic measures, so important in the amelioration of these conditions. Indeed, Allison and Schwab, in a recent paper, propose to treat these same paralyses by alcoholization of the nerve-supply of the spastic muscles, combined with the appropriate tendon transplantations and muscle education.

But division of the posterior nerve-roots has another possible source of usefulness. It has been more or less successful in relieving intractable pains due to peripheral nerve disease, a form of treatment parallel to the extirpation of the Gasserian ganglion or division of its sensory root in trifacial neuralgia, and it has been shown to have a pronounced curative influence upon the gastric crises of tabes.

The surgical treatment of diseases of the spinal cord will be considered under the following heads: (1) Tumors of the spine and spinal cord; (2) injury to the spine and spinal cord; (3) spina bifida; (4) division of the posterior nerve-roots for spastic paralysis and peripheral nerve pain; (5) meningitis; (6) tuberculosis and osteomyelitis of the spine (in so far as they involve the cord).

TUMORS OF THE SPINE AND SPINAL CORD

All such tumors may, and many necessarily do, cause pressure upon the spinal cord. In a general way they can be separated into two principal classes—those growing outside the dura, and those growing within it. This classification is important because tumors of the vertebræ are for the most part malignant, and therefore incurable. Their malignancy is dependent on the fact that they are usually metastatic carcinomas and sarcomas. On the other hand, intradural tumors, though perhaps a little less numerous than extradural (at least in the present literature), are about as frequently non-malignant as the latter are malignant. The treatment of the former is, therefore, attack, vigorous and early; of the latter, palliation directed to the relief of suffering.

A chapter on treatment cannot include the details of the more fascinating side of this subject, the differential diagnosis, and especially the segmental localization of spinal tumors. More or less of this matter must necessarily come out in a discussion of the operative treatment of the curable class of tumors, but at present it is a subject to be treated by the neurologist.

With regard to diagnosis, however, certain fundamental facts must be stated, for any lesion causing pressure on the cord sets up a more or less definite chain of symptoms. The production of these manifestations depends on the fact that any one point or segment in the cord is in communication by a sensory and motor root with a corresponding segment of the body, while through it run tracts of motor and sensory fibers to points above and below. In a general way, the order in which these symptoms appear is as follows: pain, motor paralysis, sensory paralysis. A tumor, then, which presses on a certain segment of the cord first causes a disturbance of sensation in the peripheral area supplied by that segment,—a so-called "root pain,"—and as the sensory roots run upward in the canal for a considerable distance before entering the cord, it is important to remember that, according to Bruns' law, the root pains indicate pressure on a segment of cord rather than on the roots themselves. As the pressure increases, sooner or later motor symptoms appear—either the motor nerve-cells at the level of the lesion are put out of commission, causing local weakness and atrophy, or the through motor paths are interrupted, causing spasticity below it. Finally, the sensory tracts are blocked, and with this condition loss of sensation and ataxia below the level of the lesion become evident.

Extradural Tumors.—The first or extradural division of the spinal tumors—those growing in or about the vertebræ—include carcinoma, nearly always metastatic; sarcoma, often metastatic, but occasionally growing from the periosteum or dura—the two constituting by far the largest number of vertebral growths; and less commonly a number of other tumors: osteoma, multiple myeloma of the bodies, exostosis, enchondroma, lipoma (in children), teratoma of the sacral region, and the various parasitic cysts. Pachymeningitis of tuberculous or syphilitic origin may perhaps be included in this category.

In a general way these extradural growths cause bilateral pressure symptoms in contradistinction to the early unilateral signs of intradural tumors. The common malignant growths are rapid in development, extremely painful from early root involvement, and are usually associated with local tenderness or deformity, while the rarer nonmalignant variety run a course very similar to that of intradural tumors.

Treatment.—For malignant tumors a radical cure is hopeless, if only on account of the parent growth. If an operation is undertaken with the idea of extirpation, and the tumor is found to be inoperable, division of the cord above the growth, or at least section of the nerve-roots involved, may be a proper and humane undertaking.

Special attention should be given to the bladder, rectum, and trophic disturbances. If there is bladder paralysis, constant catheterization or drainage must necessarily be instituted. Just as in total transverse division of the cord in fracture-dislocations the bladder may be most conveniently drained by a tight-fitting suprapubic tube. Some surgeons prefer, in cases of incontinence of urine, to allow the urine to dribble, and to devise some means of keeping it from constantly soiling the patient. It seems to the writer that the cleaner method of drainage by a suprapubic tube is preferable. The operation can be performed in cases of complete sensory paralysis without an anesthetic, while the after-care is pleasanter for both patient and attendants. It is rarely possible by any means to prevent infection of the urinary tract for many years, though the long-continued use of the glass catheter in the female has given excellent results. Bedsores must be avoided, if possible, by a water- or air-bed and vigilant nursing, especially the latter. The bowels must be moved regularly by cathartics and enemas. If operation has not relieved the root pains, morphin is frequently necessary.

The rarer non-malignant tumors of the bone or periosteum are to be treated by laminectomy and excision. The technic of operation will be described under the head of the intradural growths with which such tumors are most likely to be confused.

Intradural Tumors.—These may again be divided into extramedullary and intramedullary varieties—the former the more frequent and by far the more important from the standpoint of treatment, for they are the least malignant. It is these tumors which present to us at one time the text-book classic symptoms, and at another the most puzzling variations.

Extramedullary tumors,* in all probability, are usually endotheliomas, rather than sarcomas, though they have usually been described as sarcoma, fibrosarcoma, myxosarcoma, etc., and fibromas have occasionally been found. Their course is slow—lasting often over many years. The chronic onset of the symptoms often leads to a diagnosis of neuralgia or rheumatism. Root pains, at first unilateral, later bilateral, may precede the other symptoms by years. They are described as sharp and "tearing" in character, not related to the anatomic course of the sensory nerves, and not accompanied by tenderness along them. They may be increased by a sudden movement, such as coughing or stooping. Corresponding in level to these pains there is almost always found a zone of hyperesthesia or paresthesia, which persists whether or not in the later stages the pain disappears. Then, following upon the symptoms arising at the level of the lesion, come the symptoms due to interruption of the long cord tracts. As the tumor generally grows behind the cord, the posterior and lateral columns will usually show earliest the effects of pressure. A number of tracts, both sensory and motor, must necessarily be affected. Pressure upon the posterior columns will produce ataxia below the lesion by interrupting the return of sensation necessary to the maintenance of muscular balance. Pressure upon the motor tracts will produce spasticity. The two are apt to be combined. Moreover, there are frequently

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* The circumscribed cysts of the arachnoid, which will be considered in another part of the section, can hardly be distinguished by their symptoms from tumor.

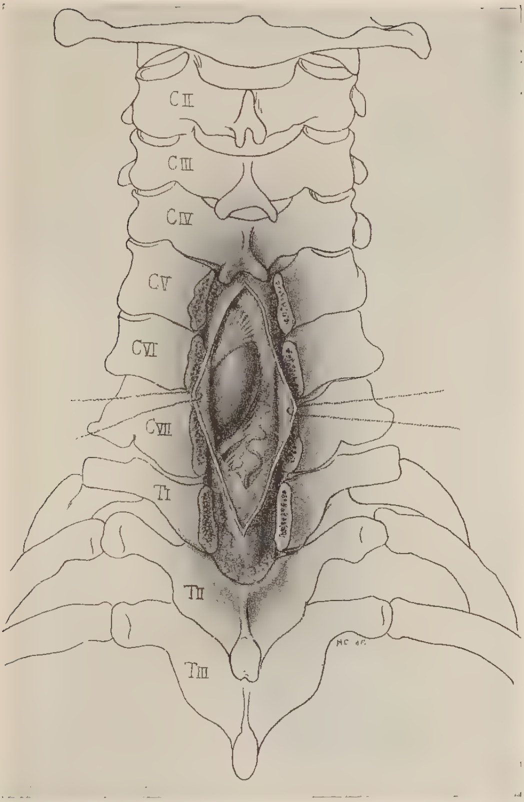

Fig. 45.—Intradural tumor of the cervical meninges. Semischematic view. From a sketch at the time of operation of the position of the growth in relation to the inclosing vertebræ (Harvey Cushing).

found, at some distance below the level of pressure, regions of painful reflex spasm not to be confused with the root pains above. While a feeling of "numbness" is a common symptom, tactile sensation is rarely completely lost below the tumor, except in the most advanced cases. Sensory paralysis usually advances from below up; motor, from above down. A common symptom with these tumors is the Brown-Séquard type of paralysis, due to the lateral position of the growth. The steadily progressive character of the symptoms, without a tendency to an upward spread, is characteristic.

Without going deeply into the possibilities of error and confusion in making a diagnosis, it is evident that the character and localization of the pain, in association with the other sensory symptoms (especially hyperesthesia) at the upper level of the growth, are the essential signs distinguishing a tumor of the cord from other pathologic conditions, such as syphilis or transverse myelitis. These same signs are chiefly important in the segmental localization or "niveau" diagnosis. If, with these symptoms, the motor signs or local spinal tenderness agree, well and good. If not, the latter are of secondary importance.

The indications for operation are well stated by Bruns, to this effect: that when the initial root symptoms begin to become bilateral, and symptoms of long tract interference (Leitungsunterbrechung) begin, then is the time to make the diagnosis and to operate. More general indications are like those of most surgical diseases. The very young bear operation badly; the old are less apt to regain lost powers. A patient completely paralyzed for years below the level of the lesion, especially with bedsores on the back, is a poor subject. Operations without much hope of relief bring discredit to a procedure requiring, at the best, a high degree of skill. It must be remembered, however, that a case of very long standing, with a badly flattened cord, may make a remarkable recovery.

Treatment.—Operation alone is curative. In planning an operation the object to be attained is to find the tumor and remove it with as little damage as possible. This means accurate localization and perfect technic. There are two sources of error in attaining the first of these requisites. One is the fact that the nerve-roots run upward inside the canal for a considerable distance before entering the segment from which their symptoms arise. The corresponding segment in the cervical region will be one vertebra higher than the level of the highest sensory nerve involved; in the upper dorsal, two higher; in the lower dorsal, three higher. All the lumbar nerves must reach the level of at least the twelfth dorsal vertebra before entering the cord, while the sacral nerves enter the conus at about the first lumbar vertebra. Laminectomy must, therefore, be performed at a higher level than the point of emergence of the root would indicate.

The second, again, will lead the surgeon to enter the canal at too low a level. It has been found that the upper border of lost sensation alone does not indicate the highest segment involved. As each skin segment is supplied from at least three spinal segments (Sherrington), there is nearly certain to be a partially anesthetic, paresthetic, or most often hyperesthetic zone above it. This zone of hyperesthesia or paresthesia, commonly found above the anesthetic or relatively anesthetic level, indicates the highest segment compressed, and the tumor may even impinge on the segment above this. It usually corresponds to the highest root pain, but may be even higher. Suppose sensation is lost in the area supplied by the fifth dorsal nerve-roots: the tumor will be at least as high as the fourth and possibly the third dorsal segment. To disclose the tumor the operator must go up two vertebræ higher than the fourth root to reach the corresponding segment—that is, remove the laminæ of the first, second, and third dorsal vertebræ.

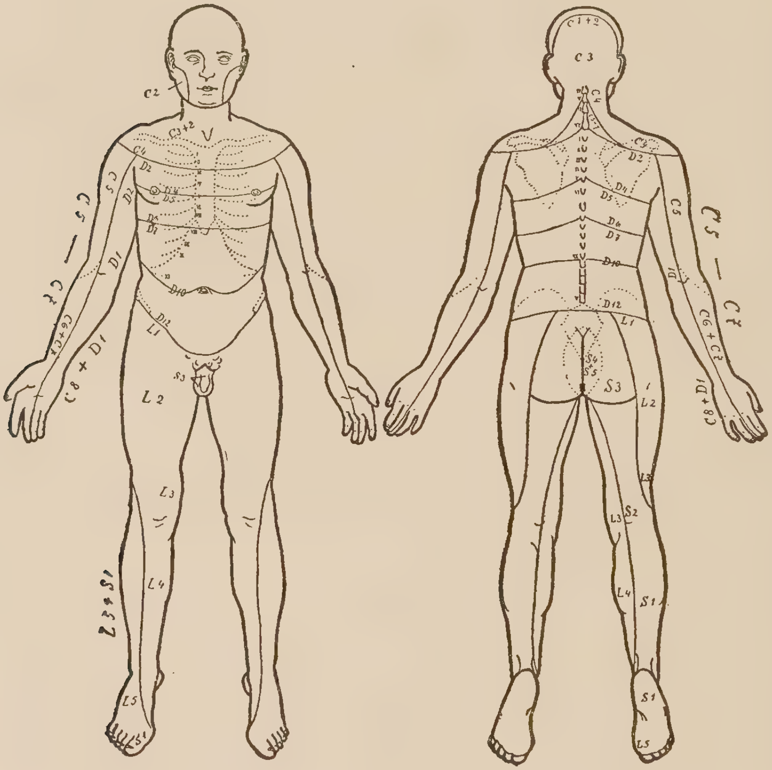

Fig. 46.—Diagram showing sensory supply of the spinal cord segments (Seiffer).

The distribution of the spinal cord segments is shown in the accompanying diagram (Fig. 46). The upper cervical nerves, through the fourth, supply the neck and upper part of the chest. The fifth, sixth, seventh, and eighth cervical and first dorsal supply the arms. The skin areas upon the chest and back corresponding to the fourth cervical and second dorsal segments are, therefore, contiguous. The nipples are in the distribution of the fourth and fifth dorsal nerves, while the region of the umbilicus is supplied by the tenth. The lower limit of the twelfth dorsal segment is the pubis in front and the upper part of the sacrum behind. The lumbar nerves supply the front, and the sacral the back of the legs, while the anal region is, segmentally, the lowest of all.

Unless a surgeon has had considerable experience in localizing cord lesions, he should be guided here by the neurologist. His technic, however, ought to be his own. In no part of the body is absolute asepsis more imperative. The skin may have a twenty-four-hour preparation or not, according to the surgeon's habit, but bedsores should be cleaned immediately before operation with crude carbolic and covered with a sterile dressing. Urotropin, 10 to 15 grains, ought always to be given immediately before ether is started, and continued, by mouth or by rectum, in the early convalescence.

The patient's position is a matter of importance. Some surgeons use a Sims position, in which they get good posterior bowing of the spine without interference with respiration. Others operate with the patient prone, and raise the center of the table or place a pad under the abdomen. For cervical and high dorsal operations the shoulders should be supported and the head dropped forward upon a rest. In all cases the head must be at a lower level than the site of operation, to prevent the escape of an excessive amount of cerebrospinal fluid.

The incision * down to the muscular layers should be long enough to expose freely at least three spines. It should be median, or may be slightly curved to one side to form a flap. The incision is then carried, as a series of figures-of-eight, along the spines, hugging them closely and taking the median line between them. If possible, the periosteum is scraped off with the muscle at each side, not so much to allow subsequent regeneration as to avoid hemorrhage. Gauze is packed into the wound on one side, while the dissection is carried down on the other. In the same way the laminæ are laid bare. Then the sides of the deep wound are covered with layers of gauze and held open with retractors.

At this point the spines are cut away flush with the laminæ, with heavy bone forceps. The next important step—the opening of the canal—may be done in a variety of ways, it being generally agreed, however, that gradual rongeuring away of the bone is preferable to the use of saws or heavy bone forceps. Entrance is first made by a burr drill or small trephine placed over the center of each arch, after which the rest of the bone can easily be nibbled away with rongeurs.

When all bleeding from the bone has been stopped, the canal may be explored for an extradural tumor, and if such a tumor is present, it should be dissected or chiseled away, as the case may be. Before opening the dura the thick layer of fat which invests it behind must be

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* Operations intended to bring the incisions of the different layers into different planes, so that there shall not be a direct track from the skin inward, are hardly necessary on the score of asepsis. The osteoplastic operations of Urban and Bickham are to be condemned. They cause more hemorrhage, and have no advantage over the method here described, and are awkward if the exploration has to be made more extensive. It has never been shown that removal of the spines and laminæ is of any disadvantage to the patient.

scraped away from the median line to each side to give the freest sort of approach, more especially as it is important here, as in intracranial surgery, not to injure the delicate pia beneath by reckless incision of the outer covering. By picking up the dura in the median line with a fine hook or needle, incising it with a sharp knife, and enlarging the incision up and down upon a director, the delicate transparent pial spaces are left intact. Thus far the operation has not advanced beyond the exploratory stage, where it may be stopped, and by many is stopped, even if the tumor is in sight.

The necessity of a two-stage operation depends upon two different factors. The low condition of the patient may render it advisable, though skill in the avoidance of hemorrhage will generally bring a patient to this stage in sufficiently good condition. The second element is the relation of the tumor, if present, to the cord and dura. An extramedullary tumor grows from and in the pia, and may be so embedded as to make its excision without damage to the cord a difficult matter. The pia may be incised over it at this time, and, with or without closing the dura, the tumor may be left to become extruded from its bed (Elsberg reports such a case). Moreover, if the appearance of the cord indicates the presence of a long central glioma, ordinarily considered inoperable, not only the dura but the cord itself may be split longitudinally in the median line,—a sort of decompression described and carried out by Cushing,—in which case the tumor may again be extruded.

If the operation is to be continued, the dura is held open by silk threads placed on each side. The tumor of the pia usually lies posteriorly, to one side of the median line, encapsulated, accessible, but involved in several posterior nerve-roots. At least two of these may be freely divided, if necessary, according to the findings of Sherrington, without subsequent disturbance of sensation. The vessels supplying the tumor can be tied off with fine stitches of silk or catgut and the tumor shelled out. If the growth lies in front, the same procedure may be carried out, though with greater difficulty, after gently retracting the cord to one side. The cord itself should never be touched with gauze, though it may be gently pushed aside with blunt instruments. The removal of blood should be accomplished by irrigation with warm saline solution, or clots may be gently removed with bits of moistened absorbent cotton.

If a tumor is not immediately discoverable, the canal may be explored upward and downward with a fine bougie or catheter. Even if nothing is felt in this way, it is always safe to remove the posterior arches of one or more laminæ above the wound, on the principle that an error in localization is almost constantly in the direction of placing the growth too low.

The accurate, firm closure of the wound after such an operation is an important matter. No drainage should be used. The dura is closed as completely as possible with fine silk or catgut. The muscles are united in layers with any strong suture materials, as silk or silver wire. The approximation of the skin must be perfect. The wound may then be protected by gauze and collodion, or silver-foil, and a large soft gauze dressing applied. In case the operation is to be carried out in two stages, the incision should be closed with the same care, since it is vitally important that the wound should remain free from sepsis. The second stage should then be performed four to seven days later.

Whether or not the back is immobilized is not important. As the operation has not weakened the spine, a strong support is unnecessary, but the same minute care as in the inoperable cases should be used in the protection of the patient from bedsores. Indeed, the after-treatment is exceedingly trying. Following operation the patient may have an access of root pain and of the paralysis and painful contractions below the level of the wound. Morphin is required freely at first. Improvement may begin in a few weeks and extend over a year or more. The use of the hitherto paralyzed muscles is slow and painful, though it may be assisted after a while by massage and electricity. The return of motion and sensation is in the inverse direction to their onset; that is, sensation returns from above down, and usually advances more rapidly than motion.

The treatment of intramedullary tumors has been left to the last. The only procedure which can be of any benefit was suggested in the description of the operation for extramedullary growth—that is, a sort of decompression, which, if applied early, might allow cystic degeneration to occur without hopeless damage to the cord. Such tumors are usually gliomas, growing in the region of the central canal or in the anterior part of the cord. They differ in their symptomatology from extramedullary growths in showing a tendency to extend upward, in a relative absence of root pains, in presenting the picture of a syringomyelia—that is, early dissociation anesthesia (loss of sense of temperature and pain, with retention of tactile sensation), and when they involve the anterior horns, in muscle atrophy.

INJURY TO THE SPINE AND SPINAL CORD

Roughly speaking, two-thirds of the injuries to the vertebral column are accompanied by lesions of the spinal cord. Of this number, the greater part are the so-called fracture-dislocations. Fractures pure and simple probably supply most of the remaining part of the two-thirds, and pure dislocations a still smaller proportion. In addition, certain forms of trauma may affect the cord without obvious injury to bone—the so-called distortions.

Of these various forms of injury, the fracture-dislocation has been the most thoroughly studied and discussed, for it offers the greatest difficulties in treatment, and, above all, it does the greatest amount of damage to the cord. Fracture without dislocation may or may not present so difficult a problem. It usually causes considerably less injury to the cord. Dislocation, which as a distinct lesion is probably never found except in the cervical region, does not necessarily damage the cord at all. Distortion of necessity occurs in the most flexible portions of the spine, especially the neck, and here disturbances in the cord are usually caused by hemorrhage.

This classification is practically the classic one of Kocher, given in the reverse order. In taking up the separate varieties of injury, the usual arrangement, leaving out Kocher's refinements of the fracture-dislocation, will be adhered to. Accordingly, distortions, isolated fractures of arches and spines, dislocations, and isolated fractures of the vertebral bodies will be classed as partial injuries; fracture-dislocation, as complete.

Distortions affect most commonly the cervical spine. They are brought about by violent overflexion due to blows or falls, and, as was pointed out by Thorburn in 1887, the region of the fifth, sixth, and seventh cervical vertebræ is the favorite seat. There is usually hemorrhage within or about the cord itself—hematomyelia or hematorachis. The latter probably never occurs without the former, and as it is not of itself harmful, is therefore unimportant. The symptoms of hematomyelia are peculiar and easily identified. They may appear at once or in the course of hours or days. Muscular weakness of the flaccid type at the level of the injury, accompanied by loss of pain and temperature sense, with retained tactile sensation below the level, is the classic picture. This is brought about by hemorrhage into the central portion and anterior gray matter of the cord, and as the hemorrhage tends to spread up and down, a number of segments may be involved. The distribution of the lower four cervical and upper dorsal nerves is the region principally affected. The ciliospinal center is almost certainly paralyzed, causing myosis.

Treatment.—It is first necessary to determine whether there is present dislocation or fracture. The attitude of the head in dislocation is characteristic, while fracture may be distinguished by deformity of the spines and by the Röntgen ray. The patient is to be safeguarded from further injury by immobilization of the neck and head by sand-bags or even plaster, and as spontaneous recovery is the rule in this condition, no operation is ordinarily necessary. If, however, the continually progressive character of the symptoms suggests danger to the respiratory center or permanent damage to the cord, laminectomy and the relief of pressure by opening the dura, or even splitting the cord posteriorly, might be considered. Generally speaking, operations for this condition do more harm than good.

Isolated fractures of the arches and spines, though uncommon, are almost always due to direct violence, such as a blow from a heavy object, a stab, or a bullet wound. They usually occur in the more exposed cervical and upper dorsal region. Fracture of one or more spines alone is unimportant, and treatment calls for nothing more than protection, but fracture of an arch may seriously injure the cord. Here the Röntgen ray may be of the greatest assistance in establishing the presence or absence of bony deformity. In this kind of case, in which the injury to the cord is apt to be partial, surgery is urgently called for. The indications for immediate operation are somewhat as follows: Obvious local depression or displacement of the spinous processes, with signs of incomplete cord injury,—that is, local root pains, and partial motor and sensory paralysis below the level of the lesion,—calls for operation; evidence of the presence of a bullet in the spinal canal with the same symptoms calls for operation; a septic wound leading to the spinal canal calls for it. On the other hand, very slight cord symptoms without obvious injury are not an indication for operation, nor is a clean stab wound, even with a severed cord.

In a general way operation is to be conservatively used, for misdirected efforts to remove fragments which slightly impinge upon the canal may hopelessly injure the cord. Operations at a later stage, however, for the relief of pressure from callus formation, are distinctly indicated. The treatment without operation is rest and protection rather than fixation. If the cord is partially injured, the care of the skin and bladder may be important. If a wound is present, it should be aseptically dressed.

Dislocation.—The writer prefers to treat this as an injury confined to the cervical region. Anatomically, the cervical vertebræ are so articulated that comparatively slight violence is required to force the inferior articular processes of one vertebra forward over the superior processes of the one below, and into the intervertebral notch. This may occur on one side or both, and in the latter case the intervertebral disk is almost necessarily torn. The violence necessary to produce such an injury may be a short fall on the back of the head, as out of a hammock, or even a sudden muscular action alone. The unilateral dislocation is the more common of the two. It occurs most often at the lower part of the cervical spine, though the atlas is not uncommonly dislocated upon the axis. The symptoms of unilateral cervical dislocation are characteristic. The face is turned toward the uninjured side, while the head is tilted toward the side of the injury. In bilateral dislocation the face is thrust forward and there is usually a break in the alinement of the spinous processes behind. In both conditions the neck muscles are rigid. While the cord is not commonly injured, there are usually root pains dependent upon violence to the entering nerves. The symptoms attributable to cord injury may go so far as muscular weakness and "numbness" of one or both upper extremities, and, moreover, hematomyelia may always complicate this lesion.

Treatment.—It is fair to say that sometimes the physician in charge has to keep the patient awake lest the muscles relax and allow the dislocation to reduce itself. This was literally true in a case described by Walton, where a busy practitioner found no time to take a plaster cast before the patient's dislocation was spontaneously reduced in sleep. Some cases are reduced by the relaxation of ether without manipulation. On the other hand, many are most trying. The usual technic of reduction has been traction to free the overlapping articular facets, followed by rotation of the dislocated side into place. This is dangerous and uncertain. Walton advises the following technic, which differs little from that described by Heuter in 1867, and attributed by him to Richet, a year or two before. Under ether the head and that part of the neck beyond the dislocation are tipped toward the sound side and a little backward, or, as Walton expresses it, if the head is turned toward the north, it is tipped southeast. This sets free the locked articular processes, so that with the head still tipped, rotation toward the side of the dislocation swings the lower facet of the upper or dislocated vertebra over into its original place. In this way the sound articulation is used as a fulcrum to pry the dislocated side into place. It goes without saying that, provided the patient is not in a condition of shock, the earlier reduction is attempted, the better.

While most injuries of this kind can be reduced by this method, even after a period of some months, it may be necessary in some instances to resort to further operative procedure. In case of failure, the muscles attached to the dorsal surfaces of the vertebral arch should be dissected free through a median incision. With this added knowledge of the anatomic relations of the displaced bones, and with a more exact application of power, the reduction should again be attempted. If, for any reason, this course is impracticable and several attempts at reduction have failed, the head should be supported in plaster in extension.

Double dislocation, owing to the greater narrowing of the canal, exposes the cord to more injury than the unilateral variety. One side is to be replaced at a time. The head should be extended and one side pressed back into place. Then the other side may be reduced by the method of Walton. As a variation from this, it may be possible to replace the first side by Walton's method, although theoretically, in the already narrow canal, more injury might be done to the cord. If bloodless reduction fails, the open operation may be employed, just as in the unilateral variety.

Dislocations of the atlas upon the axis may partake of the same character as those lower down in the neck. They cannot, however, be of any great extent without an accompanying fracture of the odontoid process of the axis, in which case they are usually fatal. A diagnostic sign not present in the lower cervical region is the projection of the anterior arch of the atlas into the pharynx. The roomy character of the canal is a protection against injury to the cord, but here, even more than in any other part of the neck, if serious damage is done to the cord, it necessarily results fatally. Mixter and Osgood report a case of dislocation of the atlas in which the odontoid was fractured, but in which the cord was not involved. The deformity recurred after several attempts at reduction, and it was found necessary to cut down and draw back the atlas by means of a silk thread passed around the posterior arch. At the same time pressure was made from in front through the pharynx. The bone afterward remained in sufficiently good position.

Isolated Fractures of the Vertebral Bodies.—Under this head are arbitrarily grouped the cases of fracture in which the alinement of the vertebræ is preserved, in contradistinction to fracture-dislocation, in which it is lost. The two conditions must necessarily merge into each other. The injury is usually produced by a severe blow or fall upon one end or the other of the spine; that is, upon the head, feet, or buttocks. By a force so applied, one or more vertebral bodies are crushed, often comminuted. It is obvious that the location of an injury of this kind depends upon individual anatomic variations, as well as upon the exact direction of the blow. Therefore these lesions may be found anywhere in the spinal column, though they are said to be more numerous in the lower dorsal region.

The symptoms depend, for the most part, upon the extent of the hemorrhage and edema in the cord. Locally there is usually tenderness on pressure. There may be a kyphos, which is evident when the patient is upright, and disappears when he lies down. The Röntgen ray will show a fracture of any severity. The paralysis, if present, may or may not come on immediately.* The loss of sensation is rarely extensive or clearly outlined. The prognosis is better than in the obvious compression cases.

Treatment.—Immediate operative treatment is usually uncalled for. The greatest gentleness is necessary in handling the patient lest a simple fracture be converted into a dislocation, and the more if a kyphos is present. Immobilization may or may not be necessary. As a sudden movement on the part of the patient may do incalculable damage, especially if the fracture is a cervical one, the use of plaster combined with extension is to be advised.

The application of plaster with extension to the cervical region should be made under ether. The head should project well over the end of the operating table. It should be supported by means of a sling of broad bandage passed beneath the chin and occiput and then over the shoulder of an assistant, who is seated in such a position that he can make traction while the plaster is being applied. The plaster must pass beneath the shoulders and around the body without covering the front of the neck. Such a dressing may be later replaced in convalescence by an appropriate head-brace, as for cervical Pott's disease.

For a dorsal or lumbar injury the plaster may be applied with the patient lying face down on a strip of canvas, or many turns of strong bandage stretched over a Bradford frame or from the head to the foot of an ordinary iron bedstead. The sagging of the body produces the desired extension of the spine. When the plaster is completed, the patient is laid on the back, the canvas cut across at one end, and pulled out. The general treatment is even more important. It should be planned along the same lines laid down for tumors of the cord. The writer refers, of course, to the partial as well as the complete cord lesion. For the early retention of urine, which is usually followed by incontinence, the most rigidly aseptic catheterization is demanded. While the loss of sensation is at its height the patient should be kept on a water-bed, and all parts of the body inspected daily and kept scrupulously clean. Skilful nursing is nowhere more strikingly shown than in the prevention of pressure sores and in the care of the bowels and bladder.

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* Murphy describes several cases of this character, occurring in the lower dorsal or lumbar region, in which the symptoms appeared in weeks rather than days. The course was benign. Whether this peculiarity is related to Kümmell's syndrome is not clear. The condition to which the name of Kümmell's disease is often given is a rarefying spondylitis occurring weeks or months after an often insignificant injury. In the interval there are no unfavorable symptoms. Pain, tenderness on motion, and finally a kyphos appear. The cord is usually not injured, and the deformity disappears upon suspension and immobilization.

In conclusion it may be said of the treatment of the partial cord injuries that unless they are due to the presence of depressed bone or foreign bodies, they never demand exposure of the cord itself; that they are recovered from in the course of months or years to an often surprising degree; that, aside from the reduction of obvious deformity, general treatment is more important than local. In one direction, however, these statements are subject to revision. While it is generally admitted that the extramedullary hemorrhage does not call for operation, it may yet be shown that, with the most careful technic, decompressive measures may become of advantage in the treatment of hemorrhage and edema in the cord itself.

Fracture-dislocations.—While simple fracture of the body of a vertebra is usually produced by a crushing force applied in the long axis of the vertebral column, the force which produces a fracture-dislocation results from extreme overflexion of the spine—such a force as might be applied in a cave-in, a severe fall, or a railroad accident. The result is again a crush, but one in which the anterior part of the vertebra suffers the most. Moreover, the effect of this forward bending is to displace the upper vertebra, or portion of one, forward upon the parts below. This not only exposes the cord to the sharp angle made by the deformity, but nips it between this projection and the posterior arch of the dislocated vertebra.

The cord is usually crushed beyond hope of repair. If this were always the case, or if this form of injury could always be clearly identified, treatment would not go beyond the usually palliative measures called for by a complete cord division. But the injury is not always hopeless, nor can the diagnosis of fracture-dislocation be made with absolute certainty. Fracture-dislocations occur most often in the lower cervical, lower dorsal, and upper lumbar regions. Great and generally fatal violence is required to produce them in the upper dorsal region, where they are often accompanied by fracture of the sternum. If we limit ourselves, then, to the results of violent forward bending affecting the lower neck and dorsolumbar junction, we shall cover most of the ground. Deformity, which would inevitably be present if the patient could stand, is usually absent when he is lying down. Tearing of the muscles and ligaments produces ecchymosis, which is not apparent at once. We cannot look for crepitus. Tenderness under the circumstances is unimportant, but pain is often present. The history, the region indicated by the signs of cord injury, and the

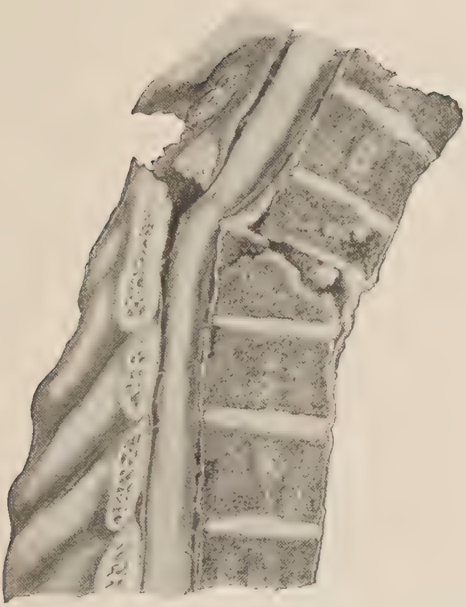

Fig. 47.—Fracture of the fourth and fifth lumbar vertebræ. Compression of the spinal cord (Wagner and Stolper).

exact nature of the symptoms themselves are, therefore, most important in making a diagnosis.

The signs of total transsection of the cord are: complete motor and sensory paralysis below the level of the divided segment; complete abolition of the deep and superficial reflexes; paralysis of the sphincters. The knee-jerk and Babinski reflex have been known to return later even in a complete transsection, but this rule is sufficient to guide us. That an incomplete cord division can, through a combination of partial laceration, hemorrhage, and edema, produce these same symptoms, there is no doubt. Therefore we cannot with certainty separate the complete and incomplete lesions and make the separation a basis for operation. We know that laminectomy can do no possible good in a total cord division. Will it do any good in a partial cord division? The chances always are that it will not.*

Finally, it must be remembered that, with the present average skill of the surgeon in a confessedly difficult field, it is important that the blame of failure should not be placed on surgery. If death, as an immediate result of the injury, is to occur without operation, it occurs early. Therefore operation should be delayed until signs of shock are past. Early operations are most often fatal in the cervical, less so in the lumbar, and still less in the dorsal, region. On the other hand, late operation or purely expectant treatment has been responsible for manifest cures and improvement.† In other words, nature will best conduct the cure in most cases, with the exception already noted. The most brilliant pieces of surgery among late operations have been performed for the removal of bone callus or fibrous thickenings due to laceration and hemorrhage in the membranes. An old rule and a good one is: Do not operate while improvement is taking place. If it stops, or if the symptoms of a partial lesion increase in severity, operate at once.

Treatment.—This may be divided into three principal divisions: First, the immediate reduction of obvious deformity; second, laminectomy for conditions bringing about and perpetuating injury to the cord; third, treatment, prophylactic and otherwise, for conditions brought about by injury to the cord.

The first division—reduction of deformity—does not vary essentially whether or not the fracture-dislocation involves the cord. If a kyphos or depression is present, reduction without an anesthetic should be attempted by extension and counterextension, aided by local manipulation. This may be done, in dorsal and lumbar injury, with the patient suspended by the shoulders and lying on his face upon an inclined Bradford frame. A plaster jacket may then be applied, as suggested under the treatment of simple fracture. Cervical fracture-dislocations should always be put in plaster with extension upon the same principle. (See p. 839.)

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* Since this chapter was written, experimental work upon crushing injuries of the spinal cord of dogs by Allm suggests that median posterior incision of the crushed cord may be of great advantage in cases where the crush is only temporary, as happens in many fracture-dislocations.

† See statistics of Lloyd

The second division—open operation for symptoms of injury to the cord itself—is dependent upon the indications already discussed. The technic is similar to that described under Tumor. Strictly speaking, fracture-dislocation does not demand such treatment except in the rare case where the laminæ are permanently displaced, as in an injury due to direct violence, and in the cases where, under efforts to reduce a deformity, immediate evidence of more damage appears. As to the matter of the relief of a physiologic block due to hemorrhage and edema following a temporary crush, and simulating a complete lesion, no definite rule can be laid down. At present there is no evidence at hand upon which to advise an operation, even could the condition be diagnosed. On the other hand, there is no reason to believe that such an advance may not be possible.*

The third division—general treatment of the paralyzed or partially paralyzed body—has already been described. It is hardly necessary to add that rest in bed beyond the period required for the firm union of a fracture is unnecessary. Carefully handled, the patient may be placed in a wheel-chair and taken outdoors. Massage and electricity are useful in restoring the circulation of the paralyzed muscles. Finally, orthopedic appliances may be necessary in the treatment of permanent disabilities. As in tumor of the cord, improvement may continue for a year or two after it has set in.

Summary of indications for the treatment of fractures:

1. Operation is contraindicated when it can do no good and may increase the damage already done to the cord. This applies to hemorrhage accompanying distortions, dislocations, and fractures which do not of themselves injure the cord.

2. Operation is contraindicated in fracture-dislocation with complete division of the cord.

3. Operation is indicated in cases of partial injury to the cord in which the symptoms are due to pressure from fragments of bone or a foreign body. Under these circumstances it is indicated as an immediate measure provided that the patient is in a condition to sustain it, and that it is not likely to increase the damage already done. It is indicated as a late measure when symptoms of improvement cease or retrogress, owing to the presence of bone callus or scar tissue formation.

SPINA BIFIDA

Failure to advance the treatment of spina bifida is due to the fact that the essential, irreparable damage caused by this malformation is done *in utero*. By the time that surgery becomes available, it is only possible to hide one of the more obvious evidences of the lesion. It is not fair to say, however, that no treatment has ever been of any avail. Operation, both early and late, has saved many a child from death by infection. It has never restored, however, the functions of paralyzed limbs, nor has it prevented the onset or brought about the disappearance of the hydrocephalus which is its most dangerous complication. It is, therefore, not curative, but palliative.

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* See note above on Allm's work on experimental crush injury of the cord. Reference to the preliminary report of this work will be found in the bibliography.

The malformation known as spina bifida consists of a defect, more or less extensive, in the posterior (rarely anterior) bony framework of the spinal column, accompanied by various malformations of the cord. The two sides of the arch which should form the posterior wall of the canal fail to unite. The cord, which originates as a groove of ectoderm, and which should end by being a closed tube the lumen of which is practically obliterated (Fig. 48), may then lie wide open, unformed and exposed to the air; it may be partially formed and then turned inside out into the bony defect (Figs. 49, 52, and 53); it may be formed, but dilate into the defect (Fig. 51); or it may completely form, while only its outer coverings protrude (Fig. 50).

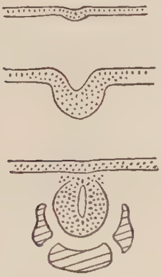

Fig. 48.—Diagram illustrating the normal development of the cord.

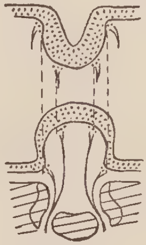

Fig. 49.—Diagram illustrating the formation of a myelocele. The dotted lines indicate the relation of the nerve-roots to the cord normally and in myelocele. (See Fig. 53.)

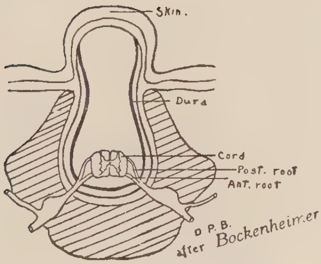

Fig. 50.—Meningocele.

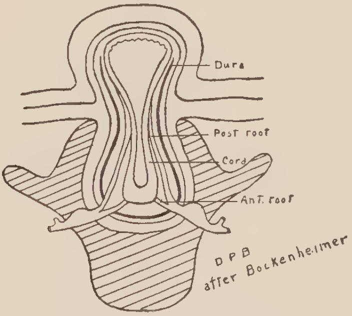

Fig. 51.—Myelocystocele.

The first of these malformations is known as rachischisis.

The second, as myelocele, myelomeningocele, or meningomyelocele.

The third, as myelocystocele or syringomyelocele.

The fourth, as meningocele.

A brief description of these conditions is necessary to make clear the diagnosis and treatment of each.

Rachischisis is rare and unimportant. The bony defect is usually complete from head to buttocks, the cord is a reddish, flat band completely unformed, and, in fact, the condition, even without the usual accompanying malformations, is incompatible with life.

Myelocele.*—This is by far the most common and well-known type of spina bifida, and probably four-fifths of these malformations are of this character. The spinal defect occupies a number of vertebræ, and is usually found in the lower dorsal, lumbar, and lumbosacral regions; rarely in the cervical. The cord itself is partly formed, to the extent of having both motor and sensory roots, but it is then thrust backward by fluid until it is everted and lies above the level of the skin, which joins it from all sides. It is therefore obvious that it can have no dural covering, and this peculiarity leads to certain appearances important in diagnosis.

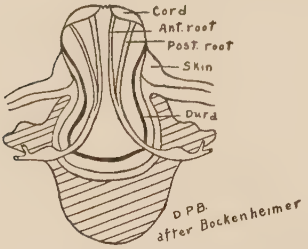

Fig. 52.—Myelocele. (Compare with Figs. 49 and 53.)

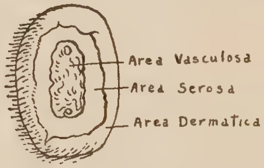

Fig. 53.—Posterior view of myelocele sac. (See Fig. 52.)

The size of the tumor is variable, depending upon the extent of the defect. It is usually raised from ½ to 1 inch above the level of the back, elliptic in shape, with its long axis vertical, and sometimes it is slightly pedunculated. Its surface may be divided into three definite zones, which, when uninjured, can be easily distinguished. About the base of the sac the skin is carried up for a short distance, forming the area dermatica. Next adjacent to this is the area serosa, pinkish in color, and lined by pia in which a network of vessels can be seen. In the center is the ciliated epithelial portion of the everted canal, the area vasculosa, red in color, delicate, and easily injured.

The most important peculiarity of myelocele, however, is the relation of the motor and sensory nerves to the sac. Normally, the motor roots leave the anterior part of the cord to reach their foramina of exit. In myelocele they still do so, but as the flattened cord is bowed backward to the very summit of the sac, they must traverse the whole depth of it to reach their exits. The sensory nerves, which normally leave the posterior surface, find themselves on the outer wings of the everted cord, and in a more nearly normal relation to their foramina. This explains the universal presence of nerve filaments in the myelocele sac, as well as the frequency of motor paralysis below the lesion.

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* The words "myelomeningocele" and "meningomyelocele," so often used to describe this condition, seem to the writer less nearly correct than "myelocele," as the meninges are hardly an important part of the sac.

Myelocystocele.—This is rather a rare variety. As it is a dilatation of the cord, it ought to be easily distinguishable from myelocele. Its membranous or cutaneous covering does not show the typical zones of the latter. Inasmuch, however, as the surface of all varieties of sac may be ulcerated and discolored, the distinction is not always clear.

Meningocele.—While this type is rare, it is the least harmful and most curable of all. The membranes alone protrude, generally through a small defect in the vertebral arches, or even between two normal arches. The sac may contain wandering nerve filaments, which are not, however, an integral part of it. It is partially or wholly covered with skin, and it is usually pedunculated. In the sacral region it is sometimes associated with teratoma.

Symptoms.—Besides the local signs already described, all forms of spina bifida may, and all but meningocele generally do, present a varying degree of muscular impairment below the level of the defect. Club-feet are frequently seen. Loss of sphincter control is present in advanced cases. Hydrocephalus, as a late complication, is common.

Treatment.—Operative treatment is indicated to save life, not to cure paralysis. The high mortality of operation—generally acknowledged to be over 40 per cent. in all kinds of cases—would be utterly discouraging if it were not for the fact that most of these infants are otherwise necessarily doomed. Operation is called for in the first months of life, to prevent rupture of the sac and consequent infection. If, however, the sac can be protected, interference should be postponed, for after five years of age the chances of a successful result are infinitely better.

Operation is contraindicated in cases of extensive paralysis with loss of sphincter control, when other incurable abnormalities are present, and, except in rare instances, in all cases complicated by hydrocephalus. It can hardly be expected to succeed in puny, ill-nourished infants.

In preparation for operation, especially upon a young infant, the diet should be regulated so that the digestion is at its best. If the child is nursing, the mother should remain in attendance. If not, the most suitable milk formula should be worked out. No precautions are too minute to be taken. The sac must be kept free from contamination by feces. As it usually oozes cerebrospinal fluid, it is apt to be covered with crusts and erosions. Silver-foil makes an excellent covering for the sac, while loose gauze or cotton may be packed around it.

The patient should be brought to the operating table with the limbs swathed in flannel, and so placed that the region of the defect is higher than the head. He should be surrounded with heaters, and no more than the space necessary for the performance of the operation should be exposed.

No unusual preparation of the field is necessary unless the surface of the cyst is ulcerated, in which case it is well to clean it with crude carbolic and alcohol. The incision is made at one side in healthy skin, and an attempt made to leave intact the delicate inner lining of the sac, by carefully dissecting off the outer coverings. To a certain extent this can be done, but in the friable central portion, the area vasculosa, to the under surface of which the nerve-roots are attached, it is almost impossible to avoid making an opening. With the nerves in sight, the outer covering is dissected from them, leaving the bundle of filaments to be replaced *en masse*.* It is especially important not to allow any of the septic outer surface to be replaced with them, and it is always better to sacrifice one or two presumably useless nerve-roots than to make a long and tedious dissection.

When this stage of the operation is completed, the remains of the cord, which in a myelocele consists principally of nerve-bundles, lie at the bottom of a wide-open cavity. If there is sufficient sac to sew over the defect, it is now closed with fine silk or catgut, or if the sac is deficient, the covering will have to consist entirely of flaps of fascia brought over from each side. With a simple meningocele, it is only necessary to dissect free the whole sac down to its neck, inspect the inside to make sure that it contains no nerve filaments, place a circular ligature about it and cut it away, or if the base is longer, it may be sewed over and over with fine catgut.

In the closure of the wound the transplantation of bone is unnecessary. A flap of fascia, or, better, muscle and fascia, is dissected up sufficiently far on each side so that it can be brought together without tension in the median line. The simpler and more bloodless the plastic is made the better, and the same is true of the closure of the skin. The simplest procedure, if undermining the edges is not sufficient, is to make two longitudinal cuts parallel to the median slit, dissect up the intervening skin, and close the central wound, leaving the lateral ones to granulate. Fine silkworm-gut, horsehair, or iron-dyed silk makes a good suture material. A dressing of silver-foil or gauze and collodion covers the wound, and a pad and swathe are applied, but it is better not to have a single large dressing, on account of the danger of soiling.

Until the wound is healed the patient is kept on the face or side, and feeding is resumed at once. Beyond this there is nothing especially important about the after-care except to keep the wound clean. For the leaking of cerebrospinal fluid which may follow the operation nothing can, or perhaps need, be done, for it may be at times a conservative process.

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* Murphy makes a point of clean division and anastomosis of the nerve filaments in the cauda equina, provided they have been involved in a scar tissue mass and are evidently out of commission. He reports improvement in the appearance of the skin of the legs under these circumstances, but no definite return of motion.

In a case of spina bifida hydrocephalus may appear at any time, or may be present from the first, though it is generally a late accompaniment. Rarely it is self-curative, as by the escape of the cerebrospinal fluid through the cribriform plate into the nose. An attempt may be made, and many times has been made, to establish drainage of the lateral ventricles, but the number of methods suggested for this purpose is an indication of their lack of efficiency. The installation of a small silver tube, topped by a flange which holds it beneath the galea of the scalp, has been temporarily successful. The tube penetrates the skull, the dura, and the usually thin shell of brain, and allows the cerebrospinal fluid to escape into the connective-tissue spaces. A more recent procedure is the callosal puncture of von Bramann, which drains the third ventricle into the subdural space. The skull is opened by a burr drill a finger's-breadth behind the bregma, and 2 to 3 cm. from the median line. The dura is not opened until the bone has been cut away as close as possible to the longitudinal sinus. During the final steps of the operation the sinus is held aside with a hook. A blunt aspirating needle with lateral openings is then insinuated between the two halves of the brain until it pierces the corpus callosum and draws fluid. To complete the operation the needle is worked about to make the opening larger, and withdrawn. In the cases described by von Bramann the results have been encouraging.

This is as far as the operative treatment of spina bifida can legitimately go at present. The palliative treatment, on the other hand, consists simply in the protection of the sac from ulceration and infection. For myelocele, which frequently exudes cerebrospinal fluid, silver-foil makes an excellent antiseptic covering, and allows the fluid to ooze into the loose gauze or cotton which is laid about the tumor. If the patient's surroundings are such that the most minute care can be taken, such measures are preferable to excision, provided it is understood that an emergency operation may have to be performed at any time.

Spina Bifida Occulta.—This is rather a rare condition, presenting a defect in the posterior arch through which there is no protrusion. The dura is intact and the spinal cord is often normal. The diagnosis is indicated by the hypertrichosis which always marks the region of the spinal defect, which is found in the lumbar or sacral region. Though slight motor and sensory disturbances may be present in early life, it is not uncommon to find partial motor paralysis and paralysis of the sphincters, appearing at the period of rapid growth which occurs between ten and sixteen years. This is said to be due to the distortion of the cord by a band of fibrous tissue which is embedded in the defect, and division of this band has relieved the patient. Aside from this, the treatment of any deformities which may occur is entirely orthopedic.

DIVISION OF THE POSTERIOR NERVE-ROOTS FOR SPASTIC PARALYSIS AND PERIPHERAL NERVE PAIN

The operation of intradural division of the posterior nerve-roots has been practised for some years for the following purposes: First, to cut off the central nervous system from painful peripheral sensation, as in ascending neuritis, herpes zoster, and certain manifestations of tabes; second, and more recently, to assist in relieving spastic conditions of the extremities associated with intracranial birth hemorrhages and other interruptions of the upper motor neurones. In the first case, the object of the operation is to relieve the patient of pain; in the second, to abolish reflex excitability of the muscles.

Peripheral Nerve Pains.—These include severe, persistent, ascending neuritis, painful neuromata of amputation stumps, post zoster pains, and, as an allied condition, the gastric crises of tabes. The theory of the operation in these conditions is that, as sensory spinal roots divided central to their ganglia, that is, within the spinal canal, are incapable of regeneration, division of a number of them must permanently relieve pain coming from the segment of the body which they supply. Several apparently hopeless cases of brachial neuritis were so treated by Abbé in 1888, at the suggestion of Dana. In two of them the arm had already been amputated before the operation was undertaken. Every other conceivable measure had been tried. In spite of the fact that the morphin habit had become firmly established, both were greatly benefited, if not cured.

If such an operation is to be performed, an exact segmental localization of the pain must be made, a sufficient number of roots must be divided to cover the segments in which the pain exists,* and it must be understood that division of all the roots serving an extremity will abolish voluntary motion in that extremity (Mott and Sherrington). For intractable pain following herpes zoster of the body the operation has the same rational indication as for neuritis of a limb. Here, however, the by-effects of the loss of sensation will be less appreciable.

A small number of cases of gastric crises in tabetics has been reported as treated in this way. The patients were wasting away, with constant vomiting and abdominal pain. On the principle that the sympathetic innervation of the stomach reaches the cord through the seventh, eighth, and ninth posterior roots, these roots were divided, with good results.

Spastic Paralysis.—The spastic conditions for which posterior root division has been performed include cerebral diplegia (Little), hemiplegia of infants and children due to birth injury and encephalitis, and, rarely, hemiplegia in adults.

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* See section on Tumor for general principles of localization and the segmental distribution of sensation. The operative technic is described under the heading of Spastic Paralysis.

The particular symptoms demanding relief are spastic paralysis of the extremities, and especially deformities caused by the overaction of certain groups of muscles, painful spasm of the affected muscles, athetosis, and reflex associated movements.

The physiologic basis of these symptoms lies in the loss of the restraining power ordinarily exerted by the motor tracts from the brain over the muscular balance of the limbs. This balance is maintained about every joint by sensory impulses from the skin, fascia, ligaments, and muscles. These impulses, passing to the motor cells of the cord, tend to keep the muscles in a state of reflex activity. If the cerebral control is cut off, the reflexes run riot and all the muscles are kept in spasm. If the sensory impulses fail to reach the cord, the muscles lose their tone and become relaxed. In the former case the reflex excitability is so heightened that simply stroking the foot may throw the leg into increasingly violent contractions, which may spread over the whole body; efforts at voluntary motion result in overaction and often painful secondary movements, while among the spastic muscles the more powerful—especially the adductors of the thigh and flexors of the lower leg and foot—outpull the weaker, and permanent contractures and deformities are produced. On the other hand, if peripheral sensory impulses are cut off, the muscles remain flaccid, and voluntary movements, if performed at all, are ataxic in character.

In all patients, then, in whom the motor cortex or pyramidal tracts are affected by hemorrhage or disease, spasticity results. The greater the destruction, the severer the spasticity. The resulting deformities are characteristic. Up to within a few years they have been treated entirely, and not particularly successfully, by orthopedic measures—muscle and tendon transplantation, muscle education, and restraining apparatus. These are now, and probably will continue to be, the most important elements in treatment. Nerve alcoholization, as demonstrated by Allison and Schwab, may be used with excellent effect to paralyze temporarily the overacting muscle groups, while the weaker ones are taught to oppose them. It accompanies and aids the necessary muscle and tendon divisions for contractures.

Division of the posterior nerve-roots is an attempt to get at the physiologic basis of the trouble. It necessarily cuts off the impulses which maintain the spasticity of the muscles. It was intended by Förster, who first demonstrated its efficiency, to be a part of a painstaking system of education of the paralyzed muscles, and not of itself a curative procedure. It was not intended that all reflexes from a limb should be done away with, for the reason already given—that no purposeful movements could then be made. Only sufficient loss of sensory impulses was to be brought about to allow whatever motor control was left to be exerted. For this purpose division of two out of every three posterior roots was considered sufficient.

So far the operation has been applied only to spasticity of the limbs. It has been more successful in paralysis of the legs than of the arms, and in diseases dating from birth and infancy than in those of later life. In Little's disease and allied conditions it is advised only in the most extreme cases, where the patient is unable to walk and where the deformity is particularly complete. It should not be undertaken unless the patient's mentality is such that he is likely to respond to subsequent training. It may be employed in spastic conditions of the upper extremity, especially in those with which painful and athetoid movements are associated.

The majority of the posterior roots of the brachial or lumbar plexus, as the case may be, are to be resected. Förster advises taking the second, third, and fifth lumbar and second sacral nerves for the leg, and the fifth, sixth, and eighth cervical and first dorsal for the arm. Any similar combination may be used. Some surgeons have resected as many as six nerves in a row, though theoretically this procedure is incorrect.

The technic of the operation does not differ from that of laminectomy for any other condition unless the unilateral exposure is to be employed. The removal of the laminæ of only one side was first practised by Abbe in resection of the posterior roots for peripheral pain. Taylor advocates it strongly, asserting that it gives an exposure 1.8 cm. broad in the cervical, 1 cm. in the dorsal, and 1.5 cm. in the lumbar region. Through this exposure all the necessary manœuvers for resecting the nerves of either side can be undertaken. He divides the laminæ close to the spines and at their outer borders with the Doyen saw.

The operation has generally been performed by complete removal of the spines and laminæ. At least three vertebræ must be uncovered. Tietze, who has done most of the operating for Förster, is a firm believer in dividing the procedure into two stages. In the first he prepares to open the dura. He then packs or closes the wound, and after several days completes the division, incising the dura in the median line.

In the cervical region the nerves are easily identified. They have a short course to their foramina of exit, and the posterior are easily distinguished from the anterior. In the lumbar region it is not only difficult to identify the roots segmentally, but also to tell the sensory from the motor. Förster has found that the first sacral nerve passes into the dura at the level of the fifth lumbar spine. He therefore advises driving a needle into the tissues at one side of the vertebral column before removing the fifth spine, and from the nerve thus identified the others can be counted. To distinguish the posterior from the anterior root, a blunt hook is passed under the two as they make for the common foramen; the sensory is seen to be lateral and a little posterior to the motor, broad and flat, while the motor is round and small. The two are easily separated by following them upward, and the posterior root is divided.

The dura is closed with a fine suture, the muscle and fascia in layers with any strong material, and the wound is not drained. As in all cranial and spinal operations, urotropin should be given just before operation and in the early convalescence.

The after-treatment is of the greatest importance. The muscles, in so far as they are permitted by permanent contractures, soon become relaxed, and the limbs tend to resume a normal attitude. Then begins the education of the muscles. The general plan is to teach the simpler movements of the limbs while the patient is lying in bed; add, somewhat later, those necessary to raise the body, and finally get to locomotion. In most cases division of some of the contracted muscles will be necessary. The whole process may take years.

It is perfectly evident, then, that posterior root division is not a panacea for spastic paralysis. Even granting that the right number of nerves is divided to subdue reflex spasm, and that there are enough motor fibers spared by the original injury to leave the patient any voluntary motion, he must go through a most thorough course of orthopedic treatment before he can begin to be considered cured. In fact, the operation is still on trial.

The subject is thus summed up by Frazier: "Theoretically we abolish the contractures and restore approximately the normal range of excursion in the movements of the limb, we eliminate the disturbing flexor reflexes of the leg and the equally disturbing reflex movements which interfere with voluntary individual movements, we make provision for the return of voluntary motion, and theoretically we should have brought about a condition which would enable the patient to use the limb for ordinary purposes. Practically, however, we find this to be true only to a very limited degree. It may be that sufficient time has not elapsed in many of the cases for the best results to be obtained. Practice, education, muscular exercise continued over a longer period, may accomplish more than we have yet observed." To which rather conservative statement it might be added that, as this operation is only some three years old, it may yet, when skilfully used in properly selected cases, accomplish results not otherwise possible. It has a sound physiologic basis.

MENINGITIS

Although meningitis is not generally considered to come within the domain of surgery, yet certain of its aspects, and especially its complications, are more or less susceptible of surgical treatment. This follows two lines: First, treatment of the infected canal during the acute stage of the disease; second, the relief of conditions due to obstruction to the flow of the cerebrospinal fluid during the later stages. The manifestation of this obstruction within the skull is hydrocephalus; about the cord, circumscribed serous meningitis. Hydrocephalus, in so far as it results from meningitis, is presumably due to the blocking of the exits from the brain by adhesions* and deposits about the roof of the fourth ventricle, the basal cisterns, and in the arachnoid spaces in general. Circumscribed serous meningitis is generally accompanied by arachnoid adhesions, but is far from being a complication of this disease alone.

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* While it has seemed best to deal very briefly with this important complication of meningitis in this section, the other after-effects due to cortical adhesions—epilepsy and paraplegia—cannot properly be treated here.

Cerebrospinal Meningitis (Due to the Diplococcus intracellularis of Weichselbaum).—The withdrawal of cerebrospinal fluid by lumbar puncture and the injection of Flexner's antimeningitic serum is a procedure too well known to require comment. Acting upon the evidence that in spite of this treatment many, if not all, fatal cases of this disease die with symptoms of increased intracranial pressure, Cushing has attempted to drain the posterior cistern through a suboccipital opening. This method has failed to give more than temporary relief, and the finding of hydrocephalus in patients so treated has led to a further step. Cushing and Sladen have treated a case of this nature by repeated ventricular tappings and the injection of serum. They observed a marked diminution in the number of organisms found in the fluid withdrawn from the ventricles (cultures from the spinal canal were sterile) and a considerable improvement in the condition of the infant. A fatal result followed a reaccumulation of the fluid, for which a final tapping was of no avail. Nevertheless, as hydrocephalus tends to appear and reappear in cases which are not rapidly fatal, and as the ventricles may then become the sole harbingers of the bacteria, the injection of Flexner's serum in combination with temporary or permanent ventricular drainage in these cases may be indicated.

Tapping the lateral ventricle may be performed in the hydrocephalic infant by aspirating through the open anterior fontanel. The tap must be made 2.5 cm. from the median line, in order to avoid the longitudinal sinus, and it is best to nick the skin and dura and aspirate with a blunt-nosed needle. The brain is often a mere shell.

In patients whose skull is solid, the same operation may be carried out by making a drill hole opposite the junction of the coronal and sagittal sutures (the bregma), and 3.5 cm. from the median line (Kocher's point). Here the ventricle is reached in the adult at a depth of about 5 cm. through the second frontal convolution. For the same purpose Keen's point of election may be used. The puncture is then made 3 cm. above the external auditory meatus, and the needle is directed toward the tip of the opposite ear.

For patients in whom it is considered desirable to establish permanent drainage of the ventricle, one of the methods described in the section on Spina Bifida may be attempted.

Tubercular Meningitis.—While this disease is not amenable to any surgical treatment, it may, like cerebrospinal meningitis, be complicated by a terminal hydrocephalus. Temporary or permanent drainage of the ventricles may then be employed.

Meningitis Due to the Streptococcus, Pneumococcus, or Other Organisms.—Although in these conditions there is no specific treatment, it is logical to establish drainage by lumbar puncture. The combination of the continued withdrawal of fluid with the free use of urotropin has been shown in some instances to be a curative measure.

Circumscribed Serous Meningitis.—It is perhaps a mistake to place this important subject under the head of Meningitis, for while it may undoubtedly follow this disease, it has often been found to occur without any discoverable etiology, as well as in association with gliosis, syphilis, and trauma. Whatever its origin,—and further study in this direction is needed,—in effect it is simply a collection of fluid beneath the dura in the arachnoid tissue. The fluid may be rather definitely encapsulated, or fill spaces the boundaries of which are not clearly marked. It is always under considerable tension and compresses the cord.

The symptoms of this condition are therefore those of subdural extramedullary tumor. They differ so little that a differential diagnosis is seldom made, with the result that serous meningitis often furnishes the surgeon a very pleasant surprise when he is operating for tumor, for, except when dependent upon disease of the cord itself, it is readily curable. The root pains are usually more extensive than those of tumor; the area of hyperesthesia at the upper level of the anesthesia is correspondingly broad, and may shift slightly from time to time. In other words, there is moderate but not destructive pressure upon a larger number of segments than with tumor. Horsley states that trophic disturbances are less apt to occur. The other pressure symptoms—spasticity and painful reflex spasm below the lesion, sphincter disturbances, "numbness" and even complete anesthesia—are similar to those of tumor. A one-sided lesion is not uncommon. The dorsal region is the favorite seat.

Treatment.—Laminectomy, and that as early as possible, is the only treatment. The dura at the site of the lesion may appear tense and fail to pulsate, and upon opening it, if the cyst is punctured, the fluid escapes in a gush. If there is a definite cyst-wall, this may be removed, but after the escape of the fluid there is seldom a definite wall to be found. Horsley makes a point of washing out the cyst with corrosive sublimate 1 : 1000, or even as strong as 1 : 500. He finds this procedure harmless. Evacuation of the fluid is, however, sufficient. The dura and muscles are closed, as usual, in layers. Drainage is unnecessary.

TUBERCULOSIS AND OSTEOMYELITIS OF THE SPINE

Tuberculosis.—Pott's disease is a rare cause of injury to the cord. The cord itself may be the seat of miliary or local tuberculosis, but even if these lesions are dependent upon disease of the bone, they cannot be treated by surgical measures. The manifestations of tuberculosis of the spine which usually affect the cord are: accumulations of tubercular pus between the bone and dura; tubercular granulation tissue pressing against or invading the dura; dural thickenings, that is, pachymeningitis; the rupture of tuberculous pus through the dura; and rarely direct pressure by a kyphos.

The symptoms are those of tuberculosis of the vertebræ plus the usual symptoms of pressure upon the cord—paraplegia, more or less complete according to circumstances, below the level of the lesion.

Treatment.—The local disease of the bone should first be treated by orthopedic methods. If, after a fair trial,—the length of which must be arbitrary, according to the experience of the surgeon,—the symptoms of cord compression are not checked or improved, laminectomy should be performed. It is especially indicated when the posterior arches as well are involved. The most favorable results have occurred when thickened dura alone is the cause of the pressure. Tuberculous masses impinging upon the cord have been removed with benefit. The dural thickening should be dissected off, the granulation tissue cureted away, and if the canal is invaded by pus, it should be drained.

It must be acknowledged that surgical treatment of such conditions has met with little success. Rarely a case recovers from both the tuberculosis and the paraplegia. In such it may fairly be questioned whether surgery was necessary at all. At the present day, when Pott's disease is quickly recognized, and treated with generally increasing skill, the complication of pressure upon the cord is becoming more and more rare.

Acute Osteomyelitis of the Vertebræ.—This is a very rare variety of a common disease. The acute suppurative process may break into the canal, which must in that case be opened and drained. The focus in the vertebra itself must be treated on the same principles as are applied to the same disease in other bones.

BIBLIOGRAPHY

GENERAL:

1. Krause: "Surgery of the Brain and Spinal Cord" (Trans.), New York, 1909.
2. Cushing: "The Special Field of Neurological Surgery; Five Years Later," Johns Hopkins Hospital Bulletin, 1910, xxi, pp. 334–336.
3. Lloyd: "The Surgery of the Spine," Phila. Med. Journal, 1902, ix, pp. 290, 332, 374.
4. Mott and Sherrington: "Experiments upon the Influence of Sensory Nerves upon Motion," Proceedings of the Royal Society, 1894–95, lvii, pp. 481–488.
5. Murphy: "Surgery of the Spinal Cord," Trans. Am. Surg. Assoc., 1906, xxiv, pp. 513–585.
6. Sherrington: "Experiments in Examination of the Peripheral Distribution of the Fibers of the Posterior Roots," etc., Philosophical Trans. of the Royal Society, Series B, 1893, clxxxiv, pp. 641–763.
7. Spiller: Keen's "Surgery," 1907, vol. ii, chapter 31.
8. Woolsey: Keen's "Surgery," 1907, vol. ii, chapter 35.

TUMOR:

9. Bailey: "Surgical Diagnosis and Treatment of Tumors in and about the Spinal Cord," Jour. Am. Med. Assoc., 1910, liv, pp. 849–854.
10. Bruns: "Die Geschwülste des Nervensystems," Berlin, 1908, 2. Aufl.
11. Elsberg: "Extrusion of Intraspinal Tumors," Jour. Am. Med. Assoc., 1910, liv, pp. 1308–9.
12. Gowers and Horsley: "A Case of Tumor of the Spinal Cord; Removal; Recovery," Medico-Chirurgical Trans., London, 1888, lxxi, pp. 378–428.
13. Harte: "The Surgical Treatment of Intraspinal Tumors," Annals of Surgery, 1905, xlii, pp. 524–542.
14. Hunt and Woolsey: "Spinal Cord Tumors," Annals of Surgery, 1910, lii, pp. 289–357.
15. Oppenheim: "Beitrag zur Diagnostik und Therapie der Geschwülste im Bereich des Centralen Nervensystems," Berlin, 1907.

INJURY:

15a. Allen: "Surgery of Experimental Lesion of Spinal Cord Equivalent to Crush Injury of Fracture-Dislocation of Spinal Column. A Preliminary Report," Jour. Am. Med. Assoc., 1911, lvii, pp. 878–880.
16. Haynes: "The Treatment of Fracture-Dislocations of the Spine," New York Med. Record, 1907, lxxi, pp. 472–474.
17. Heuter: "Notizen aus der Praxis der chirurgischen Poliklinik," Arch. f. klin. Chir., 1867–8, ix, pp. 940–951.
18. Kocher: "Die Verletzungen der Wirbelsäule," etc., Mitt. aus den Grenz. der Med. und Chir., 1895–6, i, pp. 415–480.
19. Lloyd: "Fracture-Dislocation of the Spine," New York Med. Record, 1907, lxxi, pp. 465–470.
20. Mixter and Osgood: "Traumatic Lesions of the Atlas and Axis," Annals of Surgery, 1910, li, pp. 193–208.
21. De Quervain: "Les Traumatismes du Rachis," IIme Congres de la Société Int. de Chirurgie, 1908, ii, pp. 687–734.
22. Thorburn: "A Contribution to the Surgery of the Spinal Cord," 1889, Phila.
23. Walton: "Spine Injury," Boston Med. and Surg. Jour., 1903, cxlix, pp. 445–447.

SPINA BIFIDA:

24. Bockenheimer: "Zur Kenntniss der Spina Bifida," Arch. f. klin. Chir., 1901–2, lxv, pp. 697–759.
25. von Bramann: "Die Bewerthung des balkenstichs in der Hirnchirurgie," Arch. f. klin. Chir., 1909, xc, pp. 689–700.
26. Katzenstein: "Spina Bifida Occulta," Centralblatt f. Chir., 1901, xxviii, Beilage, p. 57.
27. Lovett: "Spina Bifida," Am. Jour. Orthop. Surg., 1907, v, pp. 208–218.
28. Moore: "Spina Bifida," Surg. Gyn. and Obst., 1905, i, pp. 137–140.
29. Thorndike: "The Congenital Deformities of the Spine, Rhachischisis and Spina Bifida," Trans. Am. Orthopedic Assoc., 1899, xii, pp. 51–75.

DIVISION OF THE POSTERIOR NERVE-ROOTS:

30. Abbé: "Intradural Section of the Spinal Nerves for Neuralgia," Boston Med. and Surg. Journal, 1896, cxxxv, pp. 329–335.
31. Allison: "The Technique of Nerve Alcoholization in the Treatment of Spasticity," etc., Surg. Gyn. and Obstet., 1910, xi, pp. 595–601.
32. Allison and Schwab: "Muscle Group Isolation and Nerve Anastomosis in the Treatment of Paralysis of the Extremities," Surg. Gyn. and Obstet., 1910, xi, pp. 240–250.
33. Bennett: "A Case . . . of Acute Spasmodic Pain, etc.; Subdural Division of the Posterior Nerves," Medico-Chirurgical Trans., London, 1889, lxxii, pp. 330–348.
34. Bruns and Sauerbruch: "Die operativ Behandlung gastrischer Krisen," Mitt. aus den Grenz. der Med. und Chir., 1909, xxi, pp. 173–178.
35. Clark and Taylor: "The New Treatment of Spastic Paralysis," New York Med. Jour., 1910, xci, pp. 215–220.
36. Förster: "Ueber eine neue operative Methode der Behandlung spastischer Lähmungen," etc., Zeitschrift f. ortho. Chir., 1908, xxii, pp. 203–223.
37. Förster: "Ueber die operative Behandlung spastischer Lähmungen," etc., Therapie der Gegenwart, 1911, lii, No. 1, pp. 13–18.
38. Frazier: "The Treatment of Spasticity and Athetosis by Resection of the Posterior Nerve-roots of the Spinal Cord," Surg. Gyn. and Obstet., 1910, xi, pp. 251–263.
39. Tietze: "Die Technik der Foersterschen Operation," Mitt. aus den Grenz. der Med. und Chir., 1909, xx, pp. 559–564.

MENINGITIS:

40. Bruns: "Zur Frage der idiopathischen Form der 'Meningitis spinalis serosa circumscripta,'" Berl. klin. Woch., 1908, xlv, pp. 1753–5.
41. Cushing and Sladen: "Obstructive Hydrocephalus following Cerebrospinal Meningitis," Jour. Exp. Med., 1908, x, pp. 548–556.
42. Horsley: "Chronic Spinal Meningitis," British Med. Jour., 1909, i, pp. 513–517.
43. Munro: "Circumscribed Serous Meningitis of the Cord," Surg. Gyn. and Obstet., 1910, x, pp. 235–244.
44. Spiller: "Circumscribed Serous Spinal Meningitis," Am. Jour. Med. Sciences, 1909, cxxxvii, pp. 95–97.

45. Spiller, Musser, and Martin: "A Case of Intradural Spinal Cyst with Operation and Recovery," Univ. of Penna. Med. Bull., 1903, xvi, pp. 27–31 (56–60).

TUBERCULOSIS AND OSTEOMYELITIS:

46. Willard: "Tubercular Conditions of the Spine Requiring Surgical and Mechanical Relief," Annals of Surgery, 1905, xlii, pp. 514–523.
47. Gundermann: "Acute Vertebral Osteomyelitis," Deutsche Zeitschrift f. Chir., 1911, cix, H. 1–2, pp. 121–132.

THE TREATMENT OF THE SO-CALLED FUNCTIONAL NERVOUS DISORDERS

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Clear clinical conceptions should, whenever possible, precede a consideration of therapeutics, and in the section before us this is especially important, as the general principles which underlie the treatment of functional nervous disorders are intrinsically the same for a number of them. This statement is especially true of neurasthenia, hysteria, the traumatic neuroses, and hypochondria; it is also true of such symptomatic disorders as headache, sleep disturbances, and in a large degree of the occupation neuroses, chorea, the various choreiform affections, and of other disorders that might be enumerated. It has been thought wise, therefore, first to consider briefly the symptomatology of a group of these affections before entering into the details of treatment. Further, one of the cardinal neuroses, neurasthenia, is expressive of a generalized type, as it were, of functional nervous disorders, and it has, therefore, been thought wise to give this a rather full clinical consideration. This, it will be seen, leads to clear and direct indications for treatment—indications which, as just stated, are applicable to a large number of other and in a sense allied affections. In the discussion of the latter, the general principles indicated in the study of neurasthenia will be constantly referred to.

NEURASTHENIA; HYSTERIA; TRAUMATIC NEUROSES; HYPOCHONDRIA; THE NEURASTHENOID STATES (PSYCHASTHENIA); "GENERAL NERVOUSNESS"; NEURASTHENIA SYMPTOMATICA

Among the various generalized neuroses that present themselves, no less than five conditions should be clinically differentiated. In the first place, we have the three cardinal neuroses,—neurasthenia, hysteria, and hypochondria,—all differing vastly from one another, as we shall presently see. Secondly, we have various nervous states, the essential features of which are expressive of an underlying neuropathy—a neuropathy, it may be, brought to light by an added factor of exhaustion, or a neuropathy making its appearance as a long prodromal period to a late developing psychosis, such as the incompletely developed states of dementia præcox, paranoia, or manic-depressive insanity. To these states, which never present either the symptoms of neurasthenia or hysteria, I have applied collectively the term of the "neurasthenoid" states. The symptoms are never neurasthenic or hysterical; they simply grossly resemble neurasthenia, and are properly called neurasthenoid, not neurasthenic. The terms "psychasthenia" and "psychasthenic," introduced by Janet, have been largely employed of late years to express the same ideas.

Finally, we should bear in mind the nervous symptoms which accompany and are dependent on various visceral and general diseases, organic and functional. Here, again, the symptoms are never those of true neurasthenia, and there is present merely a neurasthenia symptomatica.

The five conditions, then, that we are to bear in mind are: first, neurasthenia; second, the neurasthenoid states (or psychasthenia); third, neurasthenia symptomatica; fourth, hysteria, and fifth, hypochondria. Let us give our attention briefly in turn to the symptoms presented by the various affections under consideration, and the distinctions obtaining among them.

NEURASTHENIA

When we come to study the symptoms of neurasthenia, we find that they are essentially those of chronic fatigue. On the surface they appear to be hopelessly multiple and complex, but it soon becomes evident that they possess unequal value. This indeed was recognized years ago by Charcot, who separated a group of symptoms which he spoke of as the cardinal symptoms. He grouped them roughly as follows: Headache, sleep disturbances, rachialgia, spinal hyperesthesia, muscular weakness, dyspepsia, genital and psychic disturbances. All other symptoms he termed secondary or tertiary. Charcot evidently selected as his cardinal symptoms those which present themselves with a certain degree of frequency. He does not appear to have made use of any other guiding principle. However, if we conceive of neurasthenia as being the neurosis of chronic fatigue, the clinical picture becomes very clear. All affections which present themselves in such generalized forms as neurasthenia, hysteria, and hypochondria, present symptoms which are readily classifiable as sensory, motor, psychic, and somatic. As soon as we begin to analyze the symptoms of neurasthenia in a systematic manner, we find that the sensory symptoms express themselves, first, in generalized fatigue sensations—*e. g.*, a general sense of tire, a general sense of weakness; secondly, as localized fatigue sensations—*e. g.*, headache, backache, and limbache. When we turn our attention to the motor symptoms, we find present, in varying degree, muscular fatigue, muscular weakness, and, above all, ready muscular exhaustion. When we turn our attention to the psychic symptoms, we find a diminution in the capacity for sustained mental effort, ready mental exhaustion, and diminution in the spontaneity of thought. When we turn our attention to the somatic symptoms, we note especially atony of the digestive tract, atony of the circulatory apparatus, anomalies of the secretions, and disturbances of the sexual functions, which can be interpreted only as signs of weakness and deficient innervation. The symptoms just enumerated I have termed the primary or essential symptoms of neurasthenia; all other symptoms are secondary or adventitious symptoms. The essential symptoms are always those of chronic and persistent fatigue, while the adventitious symptoms are, as we shall see, secondary outgrowths.

The sensory symptoms consist, first, of vague fatigue sensations, generalized in character. There is present a general sense of tire or fatigue which is very persistent. It is one of the primary or essential symptoms, and may dominate the picture as long as the neurasthenia lasts. Not infrequently there are present associated or secondary symptoms, direct outgrowths of this generalized fatigue; for instance, the patient not infrequently presents a feeling of uncertainty in regard to his movements or in regard to his environment—*i. e.*, he sometimes complains of being giddy or dizzy, without presenting any symptoms of real vertigo. Indeed, mild forms of dizziness are very frequently noted. This symptom is undoubtedly one directly referable to the asthenia, and it appears to be due to the lessened vasomotor tone of the cerebral vessels, so that slight efforts or changes of position affect the intracranial circulation. It is not impossible, on the other hand, that at times this symptom is due to an actual weakness of the various centers concerned in coördinated movement. At any rate, this dizziness is a secondary and not a primary symptom.

In addition to the general sense of tire, there are sensations of fatigue, more or less distinctly localized, such as headache, backache, or limbache. These localized achings are to be regarded as exaggerated fatigue sensations, and are also among the primary symptoms of neurasthenia. In early cases they disappear upon rest, as do other fatigue sensations, though in cases of long standing they may only be relieved and not disappear altogether upon the cessation of work. For instance, concerning headache the average statement by the patient is that mental effort of any kind brings it on, or if it be already present, makes it worse. The headache is diffuse in character, and is usually most pronounced in the occipital region, though it may be frontal or widely diffused. Not infrequently we have, associated with this headache, sensations of pressure or constriction, more especially drawing sensations in the occiput and in the back of the neck, or, on the other hand, of heaviness and fullness. These associated sensations are to be classed among the secondary or adventitious symptoms; they are probably to be referred to secondary vasomotor changes, and are in themselves only indirectly the outcome of the chronic fatigue.

The backache is usually referred to the small of the back, sometimes to the midscapular region, and at times to the sacrum. This diffuse aching, like the headache, must be regarded merely as the expression of an exaggerated fatigue sensation, and constitutes unquestionably one of the primary symptoms of neurasthenia. Not infrequently, however, we have, as in the case of headache, secondary symptoms also making their appearance. Thus, there may be present tenderness over the spine to pressure, a tenderness which is, as a rule, most marked in one or more of the following regions: over the seventh cervical spine, over the middorsal region, over the dorsolumbar juncture, over the midlumbar region, over the sacrum, or over the coccyx. These regions of tenderness constitute the symptoms which gave rise to the term "spinal irritation," employed by the physicians of a previous generation. Sometimes there is present, in addition to these symptoms of spinal tenderness, also spontaneous pain or aching referred by the patient to the substance of the spine itself. It is extremely probable that these secondary symptoms are merely the indirect outgrowths of greatly exaggerated fatigue sensations. Occasionally other areas or points of tenderness are noted in neurasthenia, such as tenderness of the teeth or gums, and sometimes diffuse tenderness of the entire head; never, however, the localized tenderness of the clavus of hysteria.

The aching of the limbs, like headache and backache, is, as already stated, to be considered a primary symptom. Not infrequently this aching bears a direct relation to the occupation of the patient; as, for instance, aching in the legs in a collector, letter-carrier, or salesman, or aching in the arms in persons with occupations in which the arms are used excessively. In addition to the simple aching, other symptoms, secondary in value, are occasionally noted; for instance, subjective numbness, pricking, formication, velvety sensations, or a subjective sense of heat or cold. The adventitious character of such symptoms is self-evident. It is to be especially noted that sensory loss, anesthesia, is never present.

When we turn our attention to the special senses, we find a similar interesting aggregation of symptoms, readily divisible into primary and secondary phenomena. As regards vision, we have first and foremost the symptoms of ready fatigue. This fatigue is, as a rule, complex in its origin. Various elements, muscular, retinal, and cortical, play a rôle. Thus, weakness and ready fatigue of the intrinsic and extrinsic muscles of the eye, weakness and irritability of the retina, and ready cortical exhaustion play rôles varying in degree in different cases. It is for this reason, doubtless, that mere correction of the eyes by glasses, as a rule, fails to relieve the eye symptoms of which the neurasthenic complains.

Disorders of hearing present the symptom of localized fatigue less plainly than do the disorders of vision. However, neurasthenic patients will often say that they cannot "hear right"; though this symptom, when investigated, proves as a rule to be psychic and not directly referable to the ear—that is, it is due to lack of the power of sustained attention and not to any true difficulty of hearing. However, there is frequently present auditory hyperesthesia, and this may be pronounced in degree. The patient may suffer exquisitely from noises, even when the latter are insignificant. Secondary auditory symptoms are also prominent; especially is this true of tinnitus, of which a very large number of patients complain.

With regard to smell and taste, fatigue symptoms are not obvious; however, olfactory hyperesthesia is not an infrequent symptom, the patient complaining inordinately of odors, not especially noticed by healthy persons. Again, neurasthenic patients are notoriously peculiar in regard to their eating, often presenting an extreme dislike of various wholesome articles of food. It is not impossible that these dislikes are, in part at least, owing to modifications of the sense of taste, similar to those presented by the other special senses.

When we turn our attention to the motor symptoms in detail, we finp, as already stated, as the primary symptom, ready exhaustion. The sense of weakness is, as a rule, referred to the legs and small of the back. There is, however, never any local weakness, nothing in the faintest degree suggesting a paresis or paralysis. Among the secondary motor symptoms we note especially tremor. This tremor is an intention tremor, and is usually fine in quality. There may also be noted at times slight spasms or twitchings in small muscular bundles here and there; for instance, in a few fibers of the frontalis of the one side, or perhaps of one or both orbiculares palpebrarum, or in other facial muscles.

The tendon reactions of the neurasthenic may be normal. More frequently, however, they present the symptom of irritability, and we find, therefore, that in the majority of cases the knee-jerks are decidedly increased. Now and then, owing doubtless to lowered muscular tone, the knee-jerks are diminished; they can, however, always be well reinforced. Occasionally also an ankle clonus is noted; it is, however, never so marked nor so prolonged as we find it in organic disease. It is most frequently faint and disappearing. The cutaneous reflexes may be pronounced or may remain unchanged; they are never altered in quality. Thus, a Babinski sign is never present.

When we turn our attention to the psychic disturbances, we find again, as the most striking symptom, a diminished capacity for sustained effort. Just as the patient is incapable of long-continued physical effort, so is he incapable of long-continued mental effort. The attempt to do brain work sooner or later brings on symptoms of exhaustion. The patient finds it more and more difficult to sustain his attention. This often alarms the patient greatly, as it gives rise to the idea that he is about to lose his mind or to lose his memory. Further, ideas do not present themselves as readily as in health. There is a true lack of spontaneity of thought, and this the patient makes known to the physician by the familiar expression, "I cannot think." Like the failure of the power for sustained attention, it is only another sign of fatigue.

The secondary psychic symptoms of neurasthenia are intensely interesting, and would justify a much more elaborate consideration than is here possible. We note, first, that the man who is chronically tired loses some of his personal force, aggressiveness, and will-power. Secondly, coupled with this lack of will-power, hesitation, uncertainty, indecision, sooner or later make their appearance. Thirdly, there is also a markedly increased irritability. That the tired man is cross is as well known to the laity as to ourselves, and this irritability is merely the expression of a more or less marked loss of self-control or inhibition. Fourthly, the man who is chronically tired is also afraid, for weakness and fear inevitably go hand in hand. Indeed, it is a well-known fact that neurasthenics are subject to spontaneous attacks of fear; this fear is causeless in origin and generalized in character. Sometimes these attacks of fear are accompanied by pallor of the face and palpitation of the heart, just as is normal fear. More rarely they are accompanied by the most pronounced signs, the patient suffering from sudden weakness, pallor, coldness of the surface, excessive tachycardia, and even relaxation of the sphincters. Such attacks are commonly mistaken for attacks of hysteria, but they bear no resemblance whatever to the latter affection. It should be added that occasionally the attack of fear is not accompanied by any physical symptoms.

If the neurasthenia occurs in a patient who does not possess a normal nervous system to start with, but who is already neuropathic by heredity,—that is, possesses a nervous system structurally defective, feeble in resistance, and prone to degenerative change,—certain special symptom groups may present themselves. These have been variously termed by different writers the neurasthenic insanities, and have been described collectively by Janet as psychasthenia. They clearly have not to do with neurasthenia proper, for in a non-neuropathic subject a neurasthenia will always remain a neurasthenia simplex, and true and uncomplicated neurasthenia never terminates in mental disease.

In addition to the psychic symptoms here described, the patient also suffers from insomnia. Mostly he has but little difficulty in falling asleep, but the sleep is broken, especially toward the morning hours, and the patient finds difficulty in falling asleep again. If he does, the second sleep is likely to be heavy and the awakening to be accompanied by a feeling of more or less marked prostration. Occasionally the sleep is interrupted a number of times, and often is accompanied by a desire to empty the bladder. Less frequently the patient has difficulty in falling asleep, the oncoming of the first sleep being delayed for an hour or more. The sleep of neurasthenics is rarely refreshing. The patient usually awakens with a feeling of lethargy and depression, and feels but little inclined to activity, especially in the early part of the day.

The somatic symptoms of neurasthenia, like the other symptoms thus far detailed, present as their essential characteristics ready exhaustion. Thus we have, as the cardinal symptoms of the indigestion of neurasthenia, atony, delay, and enfeeblement. The disturbances of digestion may be intestinal as well as gastric, while constipation is almost the rule. Secondary symptoms are, of course, present here as well as elsewhere. The indigestion may become so pronounced as to lead to the production of a secondary gastric catarrh. On the other hand, the nervous weakness may manifest itself not so much by atonicity of the bowel—that is, constipation—as by looseness, and the patient may not infrequently present the symptoms of sudden and precipitate bowel movements, accompanied by sudden faintness and prostration.

The disturbances of the circulatory apparatus consist in modification of the force and rhythm of the heart's action, in the character and frequency of the pulse, and in more or less marked alterations of vasomotor tonus. Perhaps the most striking, if not indeed the most common, symptom of circulatory disturbance is palpitation of the heart. While frequently associated with digestive disturbances, it is by no means dependent upon the latter, and frequently comes spontaneously. We note also coldness of the hands and feet. Sometimes lividity, local flushings, and other signs of vasomotor disturbance are noted. The circulatory disturbances, like the digestive disturbances, are to be referred to diminished or defective innervation, and are as much the expression of fatigue as are the other symptoms already considered.

The disturbances of the secretions, more especially of the skin and of the kidneys, are to be referred to deficient innervation, and cannot be more than alluded to here. The disturbances noted in the skin consist of undue moisture of hands and feet, undue sweating upon exertion, or, on the other hand, of unusual dryness. As regards the urine, the quantity may be increased or diminished. The secretions, both perspiration and urine, may, in addition, show chemical modifications and other changes secondary in character which space will not permit us to consider.

The sexual disturbances of neurasthenia are notably those of ready exhaustion, weakness, and irritability. The patient may complain of diminished sexual power, of premature ejaculation, and of diminution of the sensations normally accompanying the sexual act. Numerous variations of these symptoms, depending upon the sex and habits of the patient, may also be present. They are of the nature of secondary manifestations.

Treatment.—The above outline of symptoms is that of simple and uncomplicated neurasthenia, that which the writer has termed neurasthenia simplex. It is, as far as we are able to determine, a purely functional disease, and yet there is reason to believe that if neurasthenia simplex lasts for a long time—that is, many years—actual changes may supervene in the tissues and the signs of a premature senescence may make their appearance. The writer has spoken of such cases as instances of neurasthenia terminalis.

The conception of neurasthenia as a state of chronic fatigue leads to clear conceptions of its pathology. In the normal exercise of function, such as leads to normal fatigue, there are changes, chemical and morphologic, which indicate a consumption of tissue—a consumption which depends directly upon the increased oxidation attendant upon functional activity. The expenditure of energy means loss of substance, and that this conception is not entirely theoretic is evidenced by the researches of Hodge, Vas, Nissl, Mann, Lugaro, and others, in the changes in the nerve-cells which occur from function. The excessive exercise of function leads to the excessive consumption of tissue, and there can be no doubt that here we have a factor which plays a rôle in the pathology of chronic fatigue. Secondly, we must bear in mind the rôle played by the products of tissue waste. It is extremely probable that waste products circulating in the blood in normal amount are not toxic in their action, and in reality exercise an important and beneficial function in the economy. In order to obtain an idea as to the action of such substances, we need but recall the following experiment: It is well known to physiologists that if a frog muscle which has been completely exhausted by electric stimulation, and refuses any longer to respond, is washed out by injecting into its artery ordinary salt solution, the muscle again reacts to the electric current, and almost as well as before. Evidently the action of the waste products restrains or inhibits the muscular contraction; and the question arises, may it not be that this is one of nature's methods of preventing undue or excessive fatigue? If it be true that the action of the muscles is inhibited by the waste products resulting from functional activity, the same is probably true of the rôle played by waste products in other organs, more especially in the nerve-centers. Here, again, the probable physiologic action of waste products present in normal amount is to induce rest by retarding activity. Considered in this light, the various fatigue substances normally thrown into the circulation act as sedatives upon the nerve-centers, and are among the direct causes of rest and of sleep. Fatigue is as much an effect of the presence of waste substances as it is of the consumption of tissue.

Excessive exercise of function leads primarily to the excessive consumption of tissue. Under these circumstances the waste substances thrown into the circulation are present in abnormal amount, and instead of a sedative or retarding influence, exert a toxic action. They no longer act as gentle restrainers of function, as preventives of unphysiologic waste, but as poisons. In all probability their effect upon the nerve-centers is now that of irritants and excitants, and instead of inducing rest, they disturb or prevent it. Here we have, I believe, the explanation of the nervousness and the irritability of exhausted states and of the insomnia of overfatigue. However, it is extremely probable that excess of function, if persisted in, leads eventually to a perversion of the chemical changes that accompany normal function; and thus arises an additional element of toxicity.

In the treatment of neurasthenia, therefore, two problems present themselves: first, the restitution of tissue; and, secondly, the elimination of waste substances. The first implies rest and the administration of food; the second, the maintenance of the action of the skin, of the kidneys, and of the bowels. The special methods adopted in given cases are, of course, subject to a great variety of detail.

The first indication is to remove, if possible, the cause of the fatigue symptoms. If the case be one of simple and uncomplicated neurasthenia, it will generally be found that the case owes its origin to some infraction of physiologic living. In the civilization of our day no cause is more potent than overwork and nervous overstrain. In many cases, if merely so much of the strain be taken off as is in excess of the patient's strength, nature will gradually reëstablish a normal equilibrium, provided, of course, that the overstrain has not been too long continued. The cessation of overwork of itself brings about a degree of relative rest. In searching for the cause of a neurasthenia, all possible etiologic elements should be inquired into, and in this connection we should remember not only overwork, but also worry, sexual excess, and the abuse of stimulants. It can readily be comprehended that rest of itself may fail to bring relief, so long as the various unphysiologic strains to which the nervous system has been subjected are not removed. Rest, too, has a very wide application, as has already been implied, for it may vary from the slight degree of relative rest just mentioned, to the profound degree of rest that is obtained by placing the patient in bed for a more or less prolonged period of time.

Partial Rest Methods.—When the neurasthenia is not pronounced, or when the patient happens to be one who is actively engaged in business and whose obligations and responsibilities cannot be laid aside, or whose circumstances negative a treatment by rest in bed owing to the expense, it is wise to have recourse to the so-called partial rest methods. Of course, as far as possible such a patient should diminish the amount of work that he does. Secondly, he should increase the hours of rest as much as possible. He should retire early, say at nine o'clock, and rise as late as his engagements permit. He should lie down immediately after the midday meal, resting for an hour, or if possible for two hours. By following this plan, the number of hours spent in actually lying down may be greatly increased; the more, of course, the better. For this excessive rest a certain amount of complementary exercise must be prescribed, and this exercise should be taken in the open air. It may consist at first of a twenty-minute walk taken between the hours of eleven and one, or between the hours of three and five. Gradually the amount of exercise should be increased until the patient is walking upward of an hour once, or it may be twice, daily. Care, however, should be taken not to permit the patient to take too much exercise at first. In any event the amount of exercise should in the beginning be very slight. Fatigue should always be avoided, for if fatigue be induced, the very object of our treatment is defeated.

Having prescribed the proper proportion of rest and exercise, we should next take up the matter of food. The amount of this should be, if possible, large. As a rule, the quantity of nourishment can readily be increased by a very simple expedient, namely, by instructing the patient to add a definite quantity of milk, say from 4 to 8 ounces, to each meal, and to drink an equal amount between meals and on going to bed. The amount should be small at first and gradually increased until even 10 or 12 ounces at a time are taken.

We should bear in mind also that the red meats are not, as a rule, suitable for neurasthenic patients. In the latter, either the output of alloxuric bodies is increased, or their elimination is interfered with, so that a diet containing meat in large quantities is contraindicated. Starchy foods and sweets are also to be avoided, first, because they favor the formation of alloxuric bodies; secondly, because they may give rise to more or less marked digestive disturbances; and, thirdly, because their tissue-building value is comparatively low. The carbohydrates are of value when muscular energy is to be eliminated, and are not indicated in periods of rest. With regard to meats, we should, therefore, advise the patient to take the red meats, beef and lamb, sparingly. It is not wise, however, to interdict the use of the red meats absolutely in patients treated by partial methods. For a similar reason the carbohydrates should not be withdrawn altogether, but their quantity should be regulated. Fats also should be avoided for a time, and the patient restricted to small quantities of butter. The white meats, chicken, fish and oysters, and eggs should be taken freely, as should also the succulent vegetables. Celery, lettuce, and water-cress and ripe or stewed fruits should be added. Neurasthenic patients do best on a mixed diet. We should remember also that liberal feeding, that feeding in excess, is indicated.

Stimulants, alcohol, tobacco, tea, and coffee, are best withdrawn absolutely. In given cases, however, if the patient is placed under such circumstances that he cannot lessen his work, that he is burdened with imperative engagements, carries great responsibilities which must be discharged, the cup of morning coffee may be allowed, or perhaps a cup of tea may be substituted. Usually, however, the coffee can be withdrawn and replaced by a cup of hot cocoa or hot milk. With regard to patients who are in the middle or advanced period of life, and who have been accustomed to the use of wines, it may be wise to permit the use of a small quantity of claret or Burgundy at dinner. This, however, is a distinct exception to the rule. Usually neurasthenics are very susceptible to the use of alcohol. It makes them dull and heavy, and renders the discharge of their duties more difficult. Tobacco, other things being equal, should also be withdrawn entirely.

The next point we have to consider is the elimination of waste products. Many of the vague aches and distressing sensations from which neurasthenic patients suffer are doubtless due to the retention of waste substances, notably uric acid and its salts, or perhaps one should say, more generally, the alloxuric bodies. So far as possible, therefore, we should add to the plan of living simple methods by means of which the elimination of these substances is facilitated. We should, therefore, increase the amount of liquid which the patient takes. The neurasthenic quite commonly suffers from a deficient thirst, and if left to himself, drinks an insufficient amount of water. It is necessary not only to instruct him to drink water, but at times to fix the amount, usually a liberal amount, which he is to consume at stated intervals.

The various table waters may here be made use of with advantage. The free addition of milk to the diet, of course, accomplishes the same object, and often renders the addition of water in large quantities less imperative.

Next it is in order to secure free elimination by the skin, by the kidneys, and by the bowels. The skin can be stimulated very readily, of course, by a liberal use of baths and by simple rubbing. Baths, however, if used too freely, may exaggerate the general weakness and relaxation from which the patient already suffers. As a rule, the use of a simple warm sponge-bath daily, followed by gentle friction, is all that is required. A brief immersion bath will, of course, answer the same purpose. As the circulation in neurasthenics is already somewhat enfeebled, as evidenced by the coldness and lividity of the extremities, they do not react, as a rule, to cold baths, and, as a matter of actual experience, it is found that warm baths are not only well tolerated, but are productive of the best results. Finally, the time of day at which the bath is taken is of importance. Usually, in cases treated by the partial rest method, the bath should be taken in the evening, shortly before retiring. At this time it aids in relieving the fatigue of the day and also quiets the patient and prepares him for sleep. In mild cases of neurasthenia or in convalescent cases cold water is well borne, and is followed by a healthy reaction, but this is not the case when the neurasthenia is at all marked or the vasomotor tone is at all deficient. However, the patient who has been using the warm bath for a time may gradually reduce the temperature of the bath from day to day, and finally take a bath of from 60° to 50° F., which in proper cases is followed by a prompt and healthy reaction. The arterial tension, which is especially low in neurasthenics in the early hours of the day, is by this means raised, and many of the fatigue symptoms either disappear or are lessened for the time being. Tissue metabolism is also actively promoted, for observation has shown that the stimulus of the cold bath increases the consumption of oxygen and the elimination of carbon dioxid. Elaborate hydrotherapeutic apparatus to secure such results is unnecessary. The latter is usually not at the command of the patient, and only infrequently at the command of the physician, but excellent results can be achieved by very simple means.

In partial rest methods massage may, of course, also be employed, and often with advantage. It has the advantage of taking the place of exercise, which it is otherwise incumbent upon the patient to take.

Full Rest Methods.—When neurasthenia is pronounced, it becomes imperative, whenever practicable, to order the patient to bed and to institute a radical course of rest treatment. It is usually necessary to give close attention to the carrying out of the details lest the purpose of the treatment be defeated by some apparently trifling neglect. If rest is imperative, this rest must be made as nearly absolute as possible. The patient is instructed to lie quietly, not to sit up except for the special purpose of taking food, nor is the patient to leave the bed except for the purpose of emptying the bowels or the bladder. Such a degree of rest, maintained for a number of weeks, is usually sufficient for ordinary cases. However, cases of neurasthenia are met with which are so profound that the mere effort of sitting up in bed or turning from side to side is sufficient to cause distress. Such a patient must be fed by the nurse, and when he desires to change his position, he should be gently moved by the attendant. Cases requiring such stringent methods as these are infrequent, however.

It should be borne in mind that the patient should have not only physical rest, but also rest of mind, and all source of mental and emotional excitement should be avoided. With this object in view, it is necessary to cut off, or strongly to advise the patient to cut off, communication with the outside world either absolutely or in a very large degree. This necessitates the exclusion of relatives and others, as well as the interruption of all correspondence. The patient, in other words, should be isolated, and the isolation should be rigid in proportion to the severity of the case.

The isolation is sometimes, though not often, actively resisted by the patient. More frequently, however, it is the relatives who are insistent, and it is against them especially that isolation is a protection. The exhibition of anxiety by relatives and friends and the constant watching of symptoms by them serve only to convince the patient that he is seriously ill, perhaps hopelessly so; in other words, they keep up the constant suggestion of illness without meaning to do so. Isolation, however, must now and then be modified. The circumstances surrounding the patient may be such that absolute isolation is neither feasible nor wise. Occasionally it may be expedient and safe to permit a child to visit its mother at intervals, or the mother perhaps to visit the daughter. At other times facts of a business nature, especially in the case of a male patient, may necessitate modifications of the principle of isolation. With due precautions, however, these modifications are bereft of harm.

In patients treated by partial rest methods a properly proportioned amount of exercise may counterbalance the effects of the excessive rest. However, in patients treated by full rest methods exercise is not possible, and must be substituted by other means. The only measure especially at our command is, of course, massage. In the bed treatment of neurasthenia the employment of massage is imperative. It can never be dispensed with. It should, in the beginning of the treatment, be carried out gently or superficially, and should be applied for a relatively short time. Severe or deep massage given at first may greatly increase the general sense of fatigue from which the patient suffers, while local soreness or rapid action of the heart may add to his distress. Gentle massage having been instituted in the beginning, it may little by little be increased, in both depth and vigor, so that after the expiration of a variable period, say from a week or ten days, full massage is given for about an hour's duration. We should bear in mind, however, that some patients are never able to endure a very hard or prolonged rubbing.

Electricity is an adjuvant to treatment which is much inferior to the value of massage. However, it also stimulates nutrition and enables us to combat the unfavorable effects of prolonged rest in bed. It should rarely, if ever, be used in the early stage of the treatment. The patient is already very nervous, and is frequently afraid of the electric apparatus. Indeed, in many cases the excitement and the irritation which the application of the electricity causes compel its discontinuance. As a rule, it should not be employed at all, save weeks after treatment is well under way, and in some cases not until the last weeks of the treatment, preparatory to getting the patient out of bed. At this period the exercise which it gives the muscles is undoubtedly beneficial. As a rule, it is found that the slowly interrupted faradic current is the most valuable. The nurse is previously instructed as to the important motor points, so that each group of muscles undergoes a given number of contractions. It is wise also to begin by limiting the application to the flexors and extensors of the legs; later the applications should include the thighs, arms, and trunk. The duration of the treatment should not be more than twenty to forty minutes.

The diet applicable to neurasthenia has already been outlined in describing partial rest methods. Suffice it to say that in the treatment by rest in bed it is wise to begin with a moderate amount of food only. Sometimes it is wise to begin with milk alone, giving this in exceedingly moderate quantities—4 to 6 ounces at meal-times, between meals, and just before the hour for sleep. However, in most patients some solid food can be given in the beginning. As regards meats, the white meats should, as before, be preferred. The succulent vegetables, spinach, squash, stewed celery, and later peas, string-beans, and other vegetables, may be added until a full diet is reached. Eggs may, of course, also be given. Potatoes should for a long time be excluded, as should also wheat bread in any quantity. The neurasthenic, however, is preëminently in need of a mixed diet, one capable of furnishing all that the tissues require—proteids, fats, carbohydrates, vegetable acids, and salts; but this full diet should be approached gradually. The milk should be increased gradually in quantity until 8, 10, 12, or more ounces are taken six times daily. Not infrequently the patient objects to the milk. Sometimes this objection is based upon an actual idiosyncrasy, so that milk is digested with great difficulty. In such instances we may make a trial of various forms of modified milk. At times the difficulty is overcome by the addition of some alkaline water, still or effervescing, such as Vichy or Selters, or Apollinaris or artificial plain soda-water. At times the addition of a little table-salt makes the milk palatable. Finally, the milk may be predigested, or, what is often a better plan, a small quantity of some digestive powder, such as pancreatin or sodium bicarbonate, may be added to the cold milk just before the latter is taken. Buttermilk, if it can be obtained, is also of great advantage, especially if there is marked constipation. In other cases whey can be employed with benefit ; it does not, however, answer as a substitute for milk for any lengthy period. Kumiss, or rather imitation kumiss, is of much more value than whey, and is frequently well digested when milk, even modified, fails. Occasionally it is necessary to abandon milk altogether, and under such circumstances we may resort to egg feeding. Eggs are best given raw, and should be given in increasing number daily. The procedure is as follows: A raw egg is carefully opened and dropped into a cup in such a way that the yolk is not broken. The patient is then directed to swallow the egg whole and with a single effort. It is best to administer the egg without salt, lemon-juice, or other attempt at flavoring. At first it is wise to begin with one egg between meals, the number being increased to two, three, or four, and even more, as circumstances permit. Later on a raw egg is given after each meal,—sometimes two,—and thus the number of raw eggs is increased so that in many instances quite a large number are taken. As a rule, the limit is reached at eight or ten eggs. There are patients, however, who take as many as a dozen, eighteen, or even more eggs in a day. As a rule, these large quantities are well borne. Exceptionally, however, if a patient has taken a large number of eggs, the skin acquires a yellowish tinge. This is possibly related to the proteid of the yolk, which contains a certain amount of sulphur. The coloring of the skin sometimes alarms the patient, as it suggests an attack of jaundice. However, there is no discoloration of the conjunctivæ. The tint, too, is of a brighter yellow than that seen in jaundice. The staining of the skin can be made to disappear by simply withdrawing the yolk and restricting the egg feeding to the whites of the eggs only. In a few days the coloring becomes distinctly less pronounced and finally fades altogether.

The quantity of food which it is possible to administer to neurasthenic patients at rest in bed is sometimes astonishingly large, and is attended by a rapid increase in weight. If proper precautions are taken, no digestive disturbances, gastric or intestinal, accompany this surcharge of the digestive tract. Great care should, of course, be taken under massive feeding to keep the bowels open, to see that the skin is kept active by bathing, and to see that the massage is given thoroughly. No undue distention of the stomach or of the abdomen results, and when the amount is again reduced to normal, no untoward consequences are observed.

It is indispensable to give the patient a special nurse, one whose function it is to devote her entire time to her one patient. She should sleep upon a cot either in the same room as the patient or in a room immediately communicating. She should spend, counting her own sleep, twenty-two hours out of the twenty-four with her patient. As a rule, the patient is quieted and prepared for an afternoon sleep or absolute rest during the hours of from two to four. During this time the nurse may seek recreation in the open air. Furthermore, the introduction of a special nurse into the room of a patient modifies the isolation. The nurse, if properly trained and adapted to her work, may in various ways divert the nosophobic thoughts of her patient into pleasant and healthful channels. Finally, it is imperative to add that a male patient should have a male nurse.

Other things equal, the nurse had best give the massage and make the electric applications herself. The introduction of a masseuse into the room very frequently disturbs the patient. The masseuse, if she be not a very tactful person, may create havoc by the gossip and injudicious communications which she may bring into the room.

If the details of a rest treatment be properly carried out, various changes are noted, provided, of course, that the case progresses favorably. It is noted that the patient increases in weight, the muscles become firm, the extremities cease to be cold, and the patient begins to lose her pallor. The patient gradually passes into a condition of placidity and contentment. Nervousness and restlessness give way to quiet and an increasing sense of physical well-being. The patient usually remains in this condition until a large degree of improvement has been reached and maintained for some time. Sooner or later, however, mental indifference and placidity give way to spontaneity of thought and action, and to a desire for activity, both mental and physical, and the patient begins to ask permission to sit up, to leave the bed, or to begin exercising. It is found also, if the patient is weighed, that he has gained in weight. Often this gain is so marked as to bring the weight a little above the normal average.

As soon as the maximum degree of improvement has been attained, —a period which ensues at the end of six to ten weeks or more,—the patient should be permitted to leave the bed for a few minutes daily, say, five or ten minutes at a time. The process of getting the patient out of bed should be a very gradual one; otherwise the effort of sitting up may bring on a sense of weakness, trembling in the extremities, faintness, or giddiness. Symptoms such as these are, however, never observed in patients in whom proper care is exercised. Little by little the time is increased until the patient sits up five or six hours out of the twenty-four. Light passive exercises, later calisthenics, and finally a full course of Swedish movements with resistance, should be instituted. Exercise in the open air by walking or an occasional carriage-ride is added. Finally the patient is up the greater part of the day, rising late, say at 10.30 in the morning, lying down between two and four, and going to bed again some time after the evening meal. It is a good plan to complete the treatment not by sending the patient directly home, but to some nearby point in the country or at the seashore, where exercise in the open air can still further be carried out, and, if possible, among pleasant and stimulating surroundings. As a rule, a stay of two weeks at the seashore answers every purpose. During this period also the patient may gradually resume communication with her friends. The nurse should accompany the patient.

The importance of active exercise subsequent to a course of rest treatment cannot be too strongly insisted upon. The error, however, must be avoided of allowing the patient to take too much exercise, especially at first. The exercise should be little at first and steadily increased, but should always stop well within the limit of fatigue. After returning home the patient should be instructed to live conservatively, and a strictly physiologic method of living should be insisted upon. Permanent results follow a radical course of rest treatment, especially if the subsequent conduct of the case be well carried out. It is of very great consequence, before the patient finally passes from under the influence of the physician, to induce her to take up or in some way bring about the filling of her time with some agreeable and suitable occupation. Work, both mental and physical, is the best guarantee of health. Work should, of course, be within physiologic limits, and adapted to the physical and mental make-up of the patient. A too prolonged period of idleness after a course of rest treatment may favor the formation of invalid and slothful habits.

It will be noted that thus far nothing has been said as to medication, and indeed in many cases no medication is required. However, the constipation frequently present, and at times the insomnia, when marked, may demand treatment by medicines. Constipation is frequently combated by the diet and by the massage. Mild laxatives, such as sodium phosphate, preferably the effervescent preparation, or Hathorn or Friedrichshall water, may be administered in the morning, a half-hour or more before the first feeding. We should, however, not make the mistake of using salines, even when mild, for too long a period. Often a vegetable laxative, such as cascara, which is so extensively used at present, answers the purpose well. Indeed, in an atonic condition of the digestive tract cascara is especially indicated. It is best given in the form of a liquid preparation, in small doses after meals, rather than in a single dose at bedtime. At other times a pill containing small doses of compound extract of colocynth, nux vomica, and hyoscyamus, or a pill of aloes, belladonna, or strychnin, or, when a more decided laxative is desired, a pill containing small doses of podophyllin, may be administered. Generally, the laxative should be given at night. Again, atony of the stomach may suggest the use of some simple bitter. As a rule, however, this is not required. The neurasthenic, fortunately, has usually a good appetite. At times catarrh of the stomach is present as a complication, and may suggest special medication. Here the various preparations of bismuth, resorcinol, charcoal, or perhaps a pill containing nitrate of silver, administered a short time before feeding, may be used. Now and then the presence of an unusual amount of intestinal fermentation may suggest the employment of beta-naphthol or other intestinal antiseptic.

Occasionally persistent fatigue sensations, more especially fatigue pains, may indicate the employment of the various salicylates, more especially salophen or aspirin, and possibly sodium salicylate.

Not infrequently the insomnia is so pronounced that it does not yield to the massage or simple hydrotherapeutic measures, such as the warm bath or the drip-sheet. In such cases it may be necessary to employ small doses of sedatives for a time, such as the bromids, trional, sulphonal, medinal, or veronal. For obvious reasons these drugs should not be continued long, nor should they be given in unnecessarily large doses. The stronger hypnotics, such as morphin and chloral, are rarely indicated. Finally, it may be repeated that it is often possible to conduct a rest treatment from beginning to end with very little and often no medication.

Psychotherapy, unless combined with the physiologic and other remedial methods detailed above, is of little or no service. That the suggestion of returning health is of real value in neurasthenia there can be no doubt, and that an air of cheerfulness and brightness should pervade the sick-room goes without saying. Direct and indirect suggestion may both be employed with advantage in the control of special symptoms as they arise, but hypnotic or complex psycho-analytic procedures are but rarely indicated or of value.

HYSTERIA

Hysteria may be defined as a psychoneurosis, the various symptoms of which present the intrinsic evidence of a mental origin. Like the symptoms of neurasthenia, they can be roughly divided into a group of sensory, motor, psychic, and visceral symptoms.

The disturbances of sensation present themselves in the form of an anesthesia, hypesthesia, paresthesia, or hyperesthesia. The areas involved present no relation to nerve distribution or to spinal segmentation. For example, a patient may present an anesthesia of a hand, investing the latter like a glove; or of a foot, investing the latter like a stocking. Sometimes a mere segment only of a limb is involved, or there may be a patch of diminished sensation placed here or there on face, limbs, or trunk. Not infrequently it involves the entire half of the body, producing a hemihypesthesia, or, if pronounced, a hemianesthesia.

The sensory disturbances of hysteria usually involve all forms of sensation, though in certain rare instances a dissociated loss may be present; for instance, a loss of the pain sense or of the temperature sense, with preservation of the tactile sense. As stated, the disturbances of sensation may present themselves in the form of isolated patches of excessive sensitiveness in certain situations, that is, there may be present a hyperesthesia or even a hyperalgesia. The areas are usually small, and may be found upon any portion of the trunk or limbs, though they are most frequently found in certain situations, especially in a certain oval area over the ribs just below the mammary glands, and another oval area immediately over the groin. The tenderness is always extremely superficial. Very frequently, if present upon light pressure, it disappears upon deep pressure. The areas are found more frequently upon the left side of the body than upon the right. They are also quite frequently found in the form of isolated patches over the spines of the vertebræ or to either side of the spine, below the inferior angle of the scapula. Not infrequently they are found over the scalp. Occasionally they are found on the buccal mucous membrane, in the conjunctiva, the nasal mucous membrane, the vagina, or it may be the rectum.

The special senses are not infrequently involved. Especially is this true of vision. In most instances, in the latter case, it is that of contraction of the visual field the peripheral portion of the retina being anesthetic. Not infrequently so-called reversal of the color field is present. In health violet is perceived in a relatively small center, green in a somewhat larger area, red in a still larger area, yellow in a still larger area, and blue in a still larger area. In hysteria the area in which blue is perceived becomes extremely contracted, so that it falls into the field in which red is still perceived; that is, instead of the largest field being that of blue perception, it is now that of red perception. This symptom is, of course, only one of anesthesia. The sensitiveness of the retina to violet disappears first, then to green, then to blue, the red persisting until the last. In hysterical contraction of the visual field it is noteworthy that the greatest amount of contraction occurs in the eye corresponding to the side of the body in which there is also hemianesthesia or other sensory loss.

Hysterical deafness is also occasionally met with. It is usually incomplete, the hearing being merely impaired. Bone conduction is well preserved. As a rule, also, there is anesthesia of the external auditory meatus, frequently of the drum and at times of the auricle. Hysterical loss of smell and taste is also occasionally noted.

The motor symptoms of hysteria resolve themselves into palsies, contractures, tremor, and incoördination. One or more of these disturbances of the motor function may be present in a given case. If there be a palsy, it is quite commonly the case that the hysterically paralyzed limb is also anesthetic; namely, that hysterical loss of motion and hysterical loss of sensation are apt to go hand in hand. Contractures of hysteria rarely simulate contractures due to organic disease, though at times the picture of a spastic paraplegia or of a hemiplegia is simulated. The tremor consists, as a rule, of to-and-fro oscillations of varying rapidity; they may vary from four to twelve oscillations in a second; more frequently the rate is from seven to nine in a second. It does not resemble either the tremor of paralysis agitans or the coarse movements of insular sclerosis.

Incoördination, when present, may give rise to the picture of hysterical ataxia or astasia-abasia. In these cases the patient, when lying down, is, as a rule, able to move his legs normally in all directions; but when he tries to get up, walk, or stand, the ataxia is at once manifest. The gait in no way resembles that of locomotor ataxia. It is irregular and may be accompanied by grossly bizarre movements of the trunk and arms.

The tendon reflexes in hysteria are frequently exaggerated. They are rarely diminished and much more rarely lost. However, Déjérine, Steiner, Marie, Souza-Leite, Nonne, and Wiegand have observed such a loss. Loss of the tendon reflexes should always excite the suspicion of organic disease. Again, a persistent ankle clonus, such as is commonly met with in lateral sclerosis, is, in the experience of the writer, not present in true hysteria; merely a clonus, which lasts but a fraction of a second or several seconds and then disappears, is not infrequently observed. The Babinski reaction also is absent. The cutaneous reflexes in hysteria may not be at all modified. Quite frequently, however, they are diminished. In a large number of cases of hysterical hemianesthesia the tendon reflexes are exaggerated upon the anesthetic side. This rule is not, however, universal; in a few cases the reflexes are equal upon the two sides, and in a still smaller number they appear to be somewhat diminished on the anesthetic side. The cutaneous reflexes, the abdominal, the plantar, and the cremasteric reflex may be much diminished on the anesthetic side, or even abolished. At other times, again, no change may be noted.

Among the visceral disturbances of hysteria we may note vomiting, rapid pulse, vasomotor phenomena, rapid breathing, cough, yawning, retention of urine, anuria, phantom tumor, aphonia, and spurious aphasia.

Hysterical vomiting is often associated with an anorexia nervosa; that is, with a more or less marked loss of the normal desire for food. When increased frequency of the pulse is present, we note that there is no organic disease of the heart or other organs. It may be associated with localized flushings, localized edema, blue edema, or with erythema. At other times hysterical rapid breathing may be present. Frequently this symptom is unassociated with any change in the pulse-rate; there is no dyspnea, no cyanosis, no cardiac distress. When hysterical cough is present, it is not accompanied by any physical signs. Sometimes the cough assumes a bizarre form, the patient emitting sounds suggesting the crowing of a cock or the yelping of a dog. Hysterical yawning, when present, is usually frequently repeated, is greatly exaggerated, and is greatly prolonged.

The sphincters are not involved in hysteria; however, retention of urine, psychic in character, is not infrequently met with. Some times the urine is greatly diminished in amount or a condition of anuria is apparently present. Grave symptoms, such as are usually associated with the suppression of urine, are conspicuous by their absence. More frequent than anuria or diminution of urine is an excess of urine, a polyuria, the patient voiding large amounts of pale urine.

An examination of the abdomen in some cases reveals excessive distention, the patient's abdomen being greatly ballooned; occasionally the outward appearance of pregnancy is presented. Sometimes the distention is limited or irregular in outline, and then gives rise to "phantom tumor." Examination, of course, soon reveals the nature of such tumors; phantom tumors may owe their existence also to localized spasm of the abdominal muscles; they may also be discovered in other muscles.

The psychic symptoms of hysteria indicate a profound alteration in the mental state or attitude of the patient. It is especially noticeable that the patient's mind reacts abnormally to suggestion. These suggestions sometimes have their origin in conditions within and in circumstances without the patient. The most marked phenomena may result from suggestion, such as nausea, vomiting, blindness, and paralysis. Again, the sight of illness, *e. g.*, of paralysis or convulsions in others, may excite a subconscious imitation; and this may also follow the hearing of the accounts of illness in friends or acquaintances. Hysteria is very contagious, suggestions being communicated from one patient rapidly to another.

Space will not permit of the detailed discussion of the mental symptoms of hysteria; suffice it to say that the patient's mental state is largely introspective. The symptoms and their gravity are greatly exaggerated. The patient becomes self-centered, and the belief in the serious character of the illness leads to an inordinate craving for sympathy.

In addition to the symptoms above detailed, which are present more or less continuously in a hysterical patient, and to which the term "interparoxysmal" is applied by French writers, there are other symptoms of sudden or relatively sudden onset, *i. e.*, so-called hysterical seizures. Hysterical attacks vary greatly in the symptoms which they present, for they may be limited to comparatively light emotional storms, attended by weeping and by laughter, or by transient alterations of speech and conduct in which emotional factors are so dominant that even the laity recognize them as hysterical. Instead of being light, the attack may be severe. A well-defined hysterical seizure is usually preceded by a period in which the patient is somewhat depressed, avoids the members of her household, is irritable, presents lessened emotional control, weeps upon slight provocation, or laughs upon insufficient cause. This stage may last for a few hours or for several days. Hysterical stigmata, already present, may become more prominent, or new ones may make their appearance. Sooner or later a convulsion comes on, attended by a tonic spasm, during which the patient may present rigidity of all the muscles of the limbs and trunk. In contrast to epileptic seizures, this phase of rigidity is, as a rule, quite prolonged. Sooner or later, however, the tonic spasm is followed by clonic convulsions. After a time these disappear. In contrast to the epileptic seizure, the patient is not unconscious, though she quite commonly asserts, after the attack is over, that she was unconscious. Consciousness may be somewhat perverted, or indeed slightly obtunded, but not lost. A hysterical attack may be limited to a convulsion brief in duration. At other times the convulsive phenomena are followed by a period during which the patient contorts the body into various bizarre positions, or makes gestures and movements suggestive of volition and purpose. In other cases, again, these movements become more pronounced, and the patient assumes dramatic or passionate attitudes, the latter being accompanied by cries, weeping, or exclamations of distress. Little by little, however, the patient becomes quiet, the attack passes off, and sleep may follow. Individual attacks vary greatly. Some patients become rigid for long periods of time, *i. e.*, cataleptic. Others simulate coma; others, again, pass into a condition of ecstasy, apparently hearing voices or seeing visions. In still others somnambulism or lethargy make their appearance.

The symptoms of hysteria, as already pointed out, all present the impress of a mental origin. Certain it is that the palsies, anesthesias, and other stigmata bear no relation to the known facts of anatomy, such as nerve distribution and spinal segmentation. All the facts point to a cortical—that is, a psychic—origin. In hysteria there is an abnormal susceptibility to suggestion. There is a loss of the normal resistance to suggestions, so that ideas from without readily become engrafted. This abnormal susceptibility to suggestion, this lack of resistance, is apparently attended by an actual reduction in the field of consciousness. Thus, a patient who has a contraction of the visual field or who has a hemianesthesia has a reduction of consciousness, *i. e.*, the field of consciousness, as far as vision or one-half of the body is concerned, is unquestionably reduced. Again, a patient who has a hysterical paralysis of an arm, loss of sensation, as is usually the case, being also present, has the entire limb cut out of or elided from consciousness, and consciousness is correspondingly reduced. Babinski has of late years maintained that hysteria is entirely the outcome of suggestion, denying that the stigmata ever make their appearance spontaneously. He believes that the sensory losses of hysteria are always the outcome of inadvertently made suggestions at the time the patients are examined by the physician. He claims, for instance, that hysterical hemianesthesia predominates on the left side of the body, because the physician, being usually right-handed, has the brush or esthesiometer in his right hand, and naturally tests the left side of the patient's body first, thus suggesting the anesthesia which he is trying to discover. He also claims that in one hundred consecutive cases of hysteria, examined by himself with due precaution, no hemianesthesia was discovered. The limits of this article will not permit of the full discussion of Babinski's views. However, granting that his views are in the main correct, they do not explain why there are persons upon whom the inadvertent suggestions, made during unskilled and careless examinations, elicit no symptoms, in contrast with those patients in whom they do elicit symptoms. The fact that there are two such classes of persons proves that there is such a thing as hysteria. Upon all grounds the conclusion seems inevitable that hysteria owes its existence to an abnormal susceptibility to suggestion. This abnormal susceptibility must itself be accounted for by an underlying pathologic state. Babinski's view fails also to explain the remarkable association of the symptoms, an association which can be explained only upon a psychologic basis. Babinski's view fails, for instance, to explain the fact that the visual field is, as a rule, most contracted or most reduced on the same side as the hemianesthesia, or that hysterical blindness of one eye is quite commonly associated with hysterical deafness on the same side. It is more philosophic, the writer believes, to attribute such an association, as well as the predominance of stigmata on the left side of the body, to some profound and underlying morphologic and physiologic fact, such as the relatively smaller size of the right cerebral hemisphere as compared with the left, and to its correspondingly lowered resistance to functional depressing influences than its more robust fellow, the left.

Babinski has suggested the name "pithiatism" to replace that of hysteria. The word "pithiatism" is derived from two Greek words meaning "curable by persuasion." Unfortunately, some of the symptoms are not curable by persuasion, and it hardly seems a more euphonious word than hysteria, which has been long and widely accepted.

Treatment.—In the first place the physician should take care, in the study of every patient, neither to suggest symptoms nor to accentuate those already present. Inadvertence in the examination, unnecessary repetition, the manner of asking questions or of the making of physical tests, may in hysterical persons do great harm. The diagnosis of hysteria can readily be established without making elaborate or prolonged observations. Studies in which an anesthetic area is mapped out in great detail, or in which the limitations of the visual field are demonstrated during a prolonged and perhaps exhausting examination, have ill effects upon the patient. It is unnecessary, for instance, to delimit the exact extent of a painful area or to press very hard or repeatedly over such an area. Especially is this precaution necessary because it is, as a rule, easy to exclude actual visceral disease. The fact that a visceral examination results negatively is frequently a great relief to the patient's mind, and a skilful examiner may not only elicit the symptoms actually present, but may, during his examination, by his comments upon the condition of the various viscera, favorably influence the mental attitude of the patient and create in the patient's mind a belief that, after all, the illness from which he is suffering is not one of moment. In other words, the physician may, in his very first examination, make suggestions to the patient of incalculable benefit. In addition to making the most of the negative visceral symptoms present, the physician should be careful, on the other hand, to admit frankly the existence of the symptoms from which the patient complains, at the same time conveying by his manner the impression that he does not consider these symptoms serious. If his manner does not sufficiently reassure the patient, he may say in so many words that he has often met with like symptoms in other patients, and has always seen them disappear under proper treatment. On the other hand, we must not forget that a hysterical patient is frequently jealous of her symptoms,—indeed, sometimes prides herself upon them,—and is anxious that the physician shall at the outset be impressed with both their severity and their reality, and it may therefore prove to be an irretrievable blunder for the physician to minimize the symptoms unduly, or indeed at the first examination to minimize them at all. The patient might come to the conclusion that the physician making the examination does not understand her case, that he does not appreciate her condition, and that he has no sympathy for her or feeling for her, and her confidence in him may be shattered at this first interview.

The first examination of a hysterical person requires an infinite degree of tact, as much, if not more, than does the subsequent treatment. It is of the utmost importance that the physician should listen patiently to the recital of the symptoms, and that he should appear to be both interested and sympathetic. The patient should be allowed to talk freely, long, and uninterruptedly. Very gentle questions of a general character may little by little be asked, and very gradually the patient should be led up to the point of the actual medical examination. The patient, of course, would scout the idea of being hysterical; indeed, would indignantly deny such an allegation, and it is of the utmost importance that the examination by the physician should be conducted from the standpoint of internal medicine. Here the physician has two advantages. In the first place, the visceral examination, proving negative, allows him to assume a decided and convincing attitude, and, secondly, because hysteria now and then complicates and sometimes masks organic disease, places the physician in the position of discovering actual visceral disease if it be present—a fact, it need hardly be stated, of prime importance. The first interview having been completed, the physician is next asked as to the proper course to pursue. If the patient's means permit of it, and if the hysteria be of sufficient gravity, a course of rest treatment should be advised; first, because hysterical persons, owing to their unphysiologic methods of living, usually present evidences of a general disturbance of physical health, sometimes profound in character; and, secondly, because hysterical persons have often an associated neurasthenia, *i. e.*, are suffering from a so-called hystero-neurasthenia. However, thirdly, and most important of all, a rest treatment gives the physician the opportunity of isolating his patient; that is, of placing his patient amid such surroundings that he can control the mental life of the patient, can control the environment, and therefore the suggestions to which the patient may be subjected.

As in neurasthenia, the rest treatment should be carried out radically. More than ever is a nurse who is especially competent necessary in such cases. The physician should always explain the nature of the case to the nurse, and to some extent enter into the details of the symptoms. The nurse thus receives valuable hints, which are a guide both to her conduct and to her conversation. As a rule, she should endeavor, by her demeanor and general conduct, to keep up gently, day by day, the impression that the patient will get well. She should be careful, however, not to display too large an amount of sympathy. Her attitude should be that of calm, quiet, and cheerful assurance. Tact is, of course, of inestimable value, and, as in other walks of life, a nurse, no matter how well trained, may, if she lacks in these essential qualities, fail in her work. No fixed and hard rule can be given as to the exact attitude a nurse should assume. Something must be left to her own judgment. Thus, while it is harmful, as a rule, for the nurse to sympathize to any extent, some patients need sympathy; they cannot get along without it, and will not improve without it. In others, again, as is well known, the slightest show of sympathy destroys the influence of the nurse and her control over the patient. It is unnecessary to add that intimacy, personal conversations, and the undue exchange of confidences are subversive of the necessary discipline.

There is no need to repeat here the various details with regard to isolation, massage, bathing, the use of electricity, exercise, and feeding, as these have been fully considered in the treatment of neurasthenia. (See pp. 863–873.) The general principles indicated there must be followed, of course, in the case of hysteria. Special symptoms, however, require special attention, and require often modifications of our plan. The patient not infrequently centers her thoughts upon a single feature of her case, such as a given painful area or a palsy, or there may be present a nausea or a retention of urine which is ever present to the patient's consciousness. The treatment of such a special symptom becomes in many cases the key to success or failure. As a rule, special symptoms become less marked or disappear along with the general physical improvement. Often, however, this is not the case, and the fact that certain stigmata are more prominent than others makes it wise to give them special attention early in the treatment.

Special painful sensory areas should be treated by suggestion, combined with such measures as massage, hot or cold douching, or by various applications of electricity. A skilful nurse will, in the course of her massage, literally rub out the painful areas. A similar result may follow the employment of the other measures indicated. Sometimes also a placebo, coupled with a suggestion, is effectual. A capsule containing a small quantity of starch or boric acid is of special value, especially in painful stigmata about the head, such as clavus. Inguinal tenderness is sometimes exceedingly persistent, the patient often attributing the pain to an affection of an ovary, or, if it be on the right side, in accordance with the popular conception of appendicitis, she may believe that she has an appendicitis. However, the special methods above indicated rarely fail, especially when the suggestion is persistently maintained and the general health of the patient also improves.

If a palsy is present, the patient should be encouraged as much as possible to move the paralyzed member. However, with the very best intentions on the part of the patient the limb may fail to move at all; especially may this be the case at first. Later, perhaps, under the stimulating suggestion that there is a gain in strength and that the muscles are improving, the limb may move slightly in response to the patient's efforts. At times it is advisable to say, while the patient is making the effort, that the limb is actually moving or that the fingers or toes are being slightly moved. At other times it is justifiable to deceive the patient by the physician himself bringing about a slight degree of motion in the limb during the time that the patient is making the effort.

If the patient be suffering from a monoplegia, it is wise to have the patient make the desired movement with the unparalyzed member first, and subsequently to endeavor to make the movement simultaneously with both limbs. Often this plan succeeds admirably, the palsy disappearing rapidly. At other times it disappears suddenly after a skilfully made suggestion. It is not necessary, of course, to allude to the rôle of massage and electricity in the treatment of hysterical palsies. How the latter measures, especially electricity, act by suggestion need not be commented upon. As a rule, a simple, slowly interrupted faradic current, not too strong, is all that is required. The contractures of hysteria often present considerable difficulty. As a rule, passive movements, with the patient lying in bed and as relaxed as possible, are of value. Gentle, especially superficial rubbing, coupled with the suggestion that the muscles are softening, that the limb is becoming looser, will prove effectual. Sometimes the continuous galvanic current is of value, coupled, of course, with suggestion.

Palsies and contractures are, however, at times exceedingly persistent, though palsies, in the experience of the writer, are far less difficult of treatment than are contractures. Contractures sometimes present an almost hopeless difficulty. If they are allowed to persist too long, a certain degree of actual fixation may take place in the joints and fibrous tissues, and thus the difficulty may actually become mechanical. In such instances it is, of course, proper to overcome the contractures by means of free movements, if necessary, giving an anesthetic. Contractures with few exceptions disappear under the anesthetic. This is also true of contractures during normal sleep. However, if the contracture has lasted many weeks or months, it may persist even under an anesthetic or during sleep. Especially is this the case when actual fixation of joints and fibrous tissues has begun. It is imperative, as soon as a hysterical contracture has been discovered, that passive movements be at once instituted and daily maintained—perhaps given several times daily. The procedure should, of course, be coupled with suggestion. Volitional control of the affected limb should also be stimulated by exercise, especially in the execution of simultaneous movements with the opposite limb. Such procedures are frequently followed by a brilliant result. A neglected or delayed interference may be followed by permanent deformity and disability.

Hysterical disturbances of motion, especially hysterical ataxia,—the so-called astasia-abasia,—must be treated by efforts at retraining. These often accomplish marvelous results in short periods of time.

The visceral symptoms of hysteria, while usually not pronounced, are at times so marked as to demand special attention; at times they become very serious obstacles to recovery. Among these loss of appetite, nausea, and vomiting—anorexia nervosa—are often most difficult of treatment. The patient may at first object to certain articles of food, and after a while increase the list of substances which she declares she cannot take, until finally the diet becomes excessively restricted. Usually the articles objected to are the very ones which the patient most needs. At times again, in pronounced cases, every article of food is objected to, the patient manifesting extreme repugnance to food; frequently she can be persuaded to take food only in exceedingly small quantities. As a rule, the patient declares that the mere taking of food increases the nausea, and not infrequently the slightest attempts to swallow, even liquids, are followed by retching, eructations, the evolution of great quantities of gas, and marked distention of the abdomen. Sometimes suggestion, such as the repeated declaration on the part of the physician that the patient will be able to retain the food if she takes it in large quantity, is effectual. In other cases, again, suggestion fails altogether, and the patient may lose excessively in weight.

It is of the utmost value, whenever practicable, to institute a radical course of rest treatment, with complete isolation. The indications are to place the patient, in whom such profound perversion of function as anorexia nervosa has occurred, amid surroundings and under conditions in which it will be possible to bring about a restoration to simple physiologic living, and at the same time to protect the patient against the evil influences of harmful suggestions, such as they are almost always subjected to by their well-meaning but mistaken relatives and friends. It is quite clear that a rest treatment in bed, with complete isolation, offers in many cases the only favorable conditions for the carrying out of such a plan.

It may be wise, if there be much epigastric tenderness, for the nurse in giving massage to omit rubbing the epigastrium or the abdomen generally; at least at first. Later on these areas may be gradually included.

No general rule as to the food which shall be administered can be given. In many cases much can often be accomplished by making an agreement with the patient as to the kind or kinds of food which shall be attempted. As a rule, the patient at first rejects every proposition that is made by the physician, but after a little gentle argument and persuasion, some basis of agreement can be reached. If possible, this should include milk, and, indeed, if it be limited to milk, the physician has no great cause for complaint. The patient may insist upon an absurdly small quantity being given at a time. If so, the compromise reached should be adhered to, bearing in mind that much can be gained by frequency of feeding. If milk be rejected, white of egg or albumin-water may be attempted, though this must be regarded as merely a temporary expedient. As a rule, the patient becomes accustomed to the food as being given; she feels that no advantage is being taken of her, acquires confidence in both the physician and the nurse, and can be persuaded, in the course of a few days, to allow the milk or other liquid food that is being given to be increased. Whether the milk had best be modified in some way, peptonized, skimmed, diluted, made alkaline by the addition of lime-water, salted or otherwise flavored, must depend entirely upon the resourcefulness and the tactful judgment of the physician. Suffice it to say that most is gained if whole milk be administered. It may be wise to skim this slightly so as to diminish the amount of cream which is taken. Occasionally it is found that if the milk is diluted with some carbonated water, such as Vichy, fountain soda, Apollinaris, and the like, it is well tolerated. Occasionally cases are met with in which liquids as well as solids are equally rejected. In such instance we have to resort to some of the following expedients; for instance, the yolk of an egg which has been very thoroughly boiled may be powdered and mixed with sufficient salt to make it quite salty. Small quantities of this can be placed upon the tongue and the patient encouraged to swallow it. If only a beginning can be made in the way of stimulating the retention of food by the stomach, all is gained, for the patient will soon find that other foods can be retained. Occasionally a very small quantity of finely minced ham—a mere fragment, given by a teaspoon at intervals—will be retained. At other times a small piece of dried beef can be chewed by the patient and the juice swallowed. Later such a patient can be persuaded to chew a small piece of steak and to swallow the juice. The primal effort and object of all the attempts at feeding should be the restoration of the belief on the part of the patient in her ability to retain food, and, after all, the various means by which this can be accomplished depend upon the case, and must of necessity be varied. On the whole, medicines had best be avoided, as the patient is apt to reject these as promptly as the food. However, it is not infrequently found that bromids are retained when other medicines are not tolerated. If so, much is gained. Twenty grains of the bromid of ammonium, with a little aromatic spirits of ammonia, dissolved in peppermint-water and well diluted, are frequently retained, and, as it were, gratefully appreciated. Sometimes this is not the case. Under such circumstances we now and then find that morphin in small quantities is well borne. It should be given in doses of $\frac{1}{32}$ grain, repeated at intervals of one-half an hour to an hour until a gentle sedative impression has been made. Usually this occurs by the time ⅛ grain has been given. Larger doses of morphin may be employed, but their liability to induce nausea of themselves must be borne in mind. As a rule, cases of anorexia bear small doses well. The morphin may be retained if dissolved in a small quantity of water. Sometimes it is best administered in a few drops of brandy or in a teaspoonful of iced champagne. Gradually the nervousness and anxiety of the patient are allayed, and the retching and vomiting are brought under control. Small quantities of milk can now be given, and little by little the patient's confidence in her ability to take food becomes restored.

As already stated, we now and then meet with a deep epigastric tenderness which, from the absence of other signs, suggests that the mucous membrane of the stomach is itself the area of a painful hyperesthesia—a true sensory stigma. Small doses of cocain are sometimes beneficial in such cases. It should be administered in a manner similar to the morphin, or may, indeed, be combined with the latter.

Champagne by itself has not proved, in the writer's hands, a very successful expedient for the relief of anorexia nervosa. There is no objection, however, to its trial in cases in which all foods fail. Carbonated water alone sometimes proves of value.

The patient's confidence in her ability to take food having been somewhat restored, we should be content with giving small quantities, a teaspoonful or a tablespoonful of some liquid food every hour or two being sufficient. A start having been made, the amount can be increased little by little until, after days, and it may be weeks, a full feeding is reached. The approach to solid food should, of course, be cautiously made. That it should be soft or semi-solid and small in quantity goes without saying. Special effort to please the fancy and the palate may be made, such, for instance, as a very small and very thin sandwich of toast, containing between its layers a small quantity of scraped beef, the latter being well salted, and flavored perhaps, in addition, with a minute dash of pepper. A sandwich made similarly, with a small quantity of the yolk of a hard-boiled egg, may also be tried.

It every now and then occurs that for several days at a time nothing whatever is retained, and under these circumstances it is proper to resort to feeding with the nasal tube or stomach-tube. Especially is this advisable in cases in which the trouble appears to be due to difficulty of swallowing, or esophagismus. Quite frequently it is not necessary to resort to this expedient more than once, the mere preparation for the procedure being often sufficient to stimulate the patient to take a small quantity of food naturally. Now and then tubal feeding in bad cases of anorexia nervosa is unsuccessful because the patient rejects both the tube and milk as fast as they are introduced. In such instances it is perfectly proper to give, twenty minutes before the feeding is attempted, a hypodermatic injection consisting of morphin, gr. $\frac{1}{8}$ to $\frac{1}{4}$, and scopolamin, gr. $\frac{1}{200}$ to $\frac{1}{100}$. As a rule, the sedation and quiet produced by the hypodermatic greatly facilitate the giving of tubal feeding, and, a large quantity of food having been given and retained, the victory may have been gained, the patient having become convinced of her ability to retain the food.

Hypodermatic medication should, of course, be avoided save in exceptional instances. The relief given is very prompt and gratifying, but as the relief is temporary only, the patient may soon insist upon a repetition of the dose. Occasionally, when bromid or morphin is not tolerated by the stomach, suppositories of opium may be administered. These, for obvious reasons, should be used for a short period of time only.

Finally, we may add that it is rarely necessary to resort to rectal feeding in anorexia nervosa. If tried, it should be persisted in for a short time only, as the moral effect of the procedure is bad, the patient being confirmed in her opinion that there is something serious the matter with her stomach.

In the average case of anorexia nervosa the difficulty of administering food is not so profound as would perhaps be implied by the foregoing paragraphs. Most frequently the patient objects strenuously to some special article or articles of diet; strangely enough, they are frequently the very articles that the physician most desires to give. This difficulty may be met in a number of ways. When possible, the endeavor should be made to bring about in the patient an auto-suggestion favoring the dietary it is desirable to prescribe. This, of course, must be accomplished by indirect methods. Thus, the article of food—most often it is milk—may be emphatically and ostentatiously forbidden, or the nurse, having been previously instructed, should in the patient's presence mention the matter of milk. The physician in reply should treat this matter as of no consequence, or possibly ignore its mention by a shrug of the shoulders. Not infrequently the patient, finding that milk is not being forced upon her or not even mentioned in her presence, asks the physician whether he never in such cases as hers prescribes milk, and whether a trial of the milk in her case might not prove beneficial. Especially is this likely to come to pass if the amount of other food has been so limited as to be grossly insufficient. However, the indirect method of suggestion or the suggestion of the opposite not infrequently fails, and here tactful persuasion, the striking of a hard and fast agreement, as already mentioned above, should be attempted. Almost always it can be secured. The advantage gained is exceedingly great, and if followed up in the proper manner, it will prove of enormous usefulness in bringing about a successful issue. Very much, of course, must be left to the tact of the physician and his intimate knowledge of the mental make-up of the patient. The essentially psychic character of the symptoms should never be lost sight of.

Hysterical rapid breathing can, as a rule, be ignored. It usually subsides, though not always, with the improvement in the general symptoms. This is also true with hysterical retention of urine. The latter is not, as a rule, a serious complication, for the physician can rest assured that rupture of the bladder will never take place, nor is disastrous distention likely to result. The placing of the patient upon the vessel at regular but not too frequent intervals, with the suggestive sound of running water and with the withdrawal of the nurse from the room at the time, are among the expedients to be employed. Not infrequently, when distention of the bladder becomes exceedingly uncomfortable, the patient may leave the bed and evacuate the bladder upon the floor. The patient will rarely go to the extent of wetting the bed. The catheter, it is to be borne in mind, is to be used only as a last resort, and when organic distention is to be feared. Of course, the catheter is not to be used regularly.

Hysterical anuria, if present, is, of course, to be treated by the ingestion of large quantities of liquids and by the giving of simple diuretics. The anuria is not accompanied by the alarming symptoms which attend true anuria, for though a hysterical patient may secrete an exceedingly small quantity of urine, yet the latter may be very much concentrated and contain a large percentage of waste products. Frequently also the anuria is the result of crass simulation. Hysterical polyuria can usually be ignored. Hysterical frequency of micturition—which frequency is often so great that the patient passes half of the night upon the commode—may be corrected by appropriate regulation and discipline of habits.

The sleep disturbances of hysteria must be treated upon general principles. Bromids and hypnotics may be employed, but can frequently be dispensed with. As a rule, placebos are very efficacious. If radical rest methods are carried out, as the effects of full feeding, absolute quiet, and rest become manifest, and as the patient's general sense of well-being increases, the various special symptoms, including the insomnia, will subside.

In many cases of hysteria systematic rest treatment cannot, for many reasons, be instituted. Under such circumstances we are to rely upon the institution of general physiologic methods, together with suggestion. It is a wise plan, in many cases in which the general health permits this to be done, to have the patient fill her time with some occupation, mental and physical. Work is a physiologic stimulant to both mind and body, and often in hysteria exercises the most beneficial influence. Unfortunately, it is not always possible, even in suitable cases, to convince the patient as to the necessity of an occupation, and quite frequently the circumstances of the patient are such as not to make an occupation at all necessary, while the patient's education and inclination do not lead her to spending her time in a useful or interesting manner. As a rule, however, the milder cases of hysteria—that is, such as do not necessitate hospital methods—yield quite readily to simple means, and success depends here largely upon the physician's resourcefulness in adapting the means at his command to the end to be obtained.

It will be noted that, in the above consideration of the treatment of hysteria, special or complex psychotherapeutic methods have received no attention. As a matter of fact, general methods, when combined with simple physiologic procedures which raise the level of the general health, are most valuable; indeed, I might add, the only methods that are justifiable and safe. Mental rest and mental exercise, normal suggestion, both direct and indirect—these are the methods to be employed. Hypnotism is rarely, if ever, justified. The state of hypnosis is itself merely a state of hysteria artificially induced. Space will not permit me to present the facts upon which this statement is based. Suffice it to say, first, that the phenomena presented by hypnotism are indistinguishable from those presented by hysteria; second, that they are beyond all doubt pathologic; third, that the impressions produced by suggestions under hypnotism are evanescent in character; fourth, that hypnotism, repeated with sufficient frequency, will confirm and make worse an already existing hysteria; and, lastly, that the procedure is one which the experience of the profession the world over, since the days of Mesmer, has proved to yield no results of tangible value.

The psycho-analysis of Breuer and Freud demands a brief consideration. A few years ago it attracted considerable attention, both abroad and in this country; but of late—and the writer thinks justly—it is being neglected. It has never gained a real foothold in America. The method was originally devised by Breuer, who some ten years before he had, with Freud, published a book, "Studien über Hysterie" (1895), had, by psycho-analysis, cured a hysterical patient. Breuer and Freud claimed in their book that the individual symptoms of hysteria immediately and permanently disappeared whenever they were successful in fully arousing in the patient the memory of the event which was causal to the development of the symptom, together with the accompanying emotion, if added to this the patient gave the fullest possible description of the event and gave verbal expression to the emotion.

Notwithstanding the form in which it is stated, this observation, which embodies a certain element of truth, does not by any means embody a new idea. It is a common experience with physicians—not only with neurologists, but with practitioners in general—that if they can induce the patient to talk freely concerning his symptoms, especially dwelling upon the origin of the latter and the causes which led to them, the patient's mind is often relieved, the symptoms at once losing in importance and often fading away. There is an emotional relief akin to that which a child experiences when confessing to its mother some act of disobedience, some peccadillo or other trivial misconduct, the recollection of which is burdening its mind. So it is with the adult, as not only physicians, but lay persons equally know. When a patient has unloaded his mind fully in regard to some real or fancied cause of worry, great relief is experienced. There is, as it were, a relief of tension, a reëstablishment of the emotional equilibrium, and a consequent sense of comfort and relief. Patients themselves know this—nervous patients in particular; and it is for this reason that they insist on describing their troubles in detail, often with such minuteness and with such wearisome repetition as seriously to tax not only the time but the endurance of the doctor. They want to tell their story; they want to tell it fully and completely, without let or hindrance; and so anxious are they not to omit anything, that it is a common experience to have them come to our offices with long series of notes, mostly written upon small pieces of paper, in order that no point, no matter how minute, should be omitted.

The relief which patients experience by a full account of their symptoms and the inevitable concomitant emotional discharge, is seen, in a more marked degree, of course, and yet typically, in the making of confessions; at times, the demand for relief under these circumstances is so great and so insistent that the sufferer voluntarily makes statements which he knows may lead to disgrace, imprisonment, and at times even to death.

Space will not permit us to give a detailed account of Freud's method, and yet a brief consideration of it is necessary. According to the original method, the patient was first hypnotized, but subsequently hypnotism was dispensed with.

The patient lies on her back upon a couch, while the operator sits upon a chair back of the patient and out of her line of vision. Freud no longer requests the patient to close her eyes, as formerly, and avoids every touch or procedure such as would be in keeping with hypnosis. Such a séance has the character of a conversation between two persons equally awake, one of whom, the patient, is spared every possible muscular effort and every diverting sensory impression such as might disturb her in her concentration on her internal psychic processes. Inasmuch as the success of a hypnotic procedure depends upon the skill of the physician and the willingness of the patient, and inasmuch as a large number of neurotic persons cannot be hypnotized by any possible procedure, doing away with hypnotism allows Freud's method to be applied to an unlimited number of patients. On the other hand, the expansion of consciousness under hypnosis in the original method was a distinct advantage, for it gave to the physician the very psychic material of memories and conceptions required, and with the aid of which he brought about the change in the symptoms. However, Freud thinks that if his present method suffers from a corresponding disadvantage, there cannot, on the other hand, be any possibility of suggestion. Further, Freud believes that he finds a counterbalancing advantage in the involuntary thoughts to which, under the present method, the patient gives expression—thoughts involuntary and almost always disturbing, which the patient under ordinary circumstances suppresses, and which usually interrupt a connected and designed account of the past history. In order to take advantage of these involuntary ideas or conceptions of the patient, Freud requests the latter to allow herself to drift in her communication just as one would drift in a conversation in which one passes in turn to the most varied subjects. He impresses the patient, before she enters into the detailed account of her history, to tell everything that comes into her head, whether she thinks it important or unimportant, whether it seems relevant or senseless. The patient is especially requested not to suppress any thought or idea because this idea happens to be shameful or painful.

In his efforts to collect or unravel suppressed memories Freud made the following observation: In the very beginning of the account given by the patient lapses of memory become apparent. These may have to do with every-day occurrences which have been forgotten, or to relations of time or of cause which have become disturbed, so that results are obtained which cannot be understood. Freud claims that no neurotic history can be elicited which does not reveal amnesias of some form or other. If the patient be urged to fill up these lapses of memory by an increased effort of attention, it is noted that the ideas which now occur are repressed with every effort, until finally, if the memory really appears, she experiences a marked sense of discomfort. From this observation Freud concludes that the lapses or lacunæ of memory are the result of a mental action which he terms suppression (Verdrängung), and as the motive of this suppression he recognizes feelings of aversion or dislike. The psychic forces which have brought about this suppression he believes he recognizes in the resistance which is offered to the memory-reproduction.

The factor of this resistance has become one of the fundamental features of his theory. He regards the ideas which appear under these circumstances as derivatives of the suppressed psychic pictures; as transformations of the same, the direct result of the resistance offered to their reproduction. The greater the resistance, the more pronounced is this transformation. It is in this relation of these undesigned ideas to the suppressed memory that there is found the therapeutic indication of Freud's method. If we possess, he adds, a method which renders it possible to gain access from the involuntary ideas to the suppressed ones, from the transformations to the original ideas, we make previously undiscovered subconscious factors accessible to consciousness without resorting to hypnosis.

Freud's method and theory are open to many serious criticisms. The first of these is offered by the peculiar view which he holds as to the origin of hysterical obsessions. Breuer in his first patient, the patient whose case originally suggested the method, fancied or perhaps did detect in the history a cause of self-reproach or blame which had led to her hysteria, and the unloading of or confession of which led to her prompt recovery. At any rate, the studies made by his colleague, Freud, have led the latter to some very remarkable conclusions, conclusions to which comparatively few neurologists as yet have been able to subscribe. Freud believes that the various obsessions, hysterical and otherwise, have their origin in some passionate sexual action or aggression of childhood. Obsessions are, he says, always reproaches changed or evolved from the suppression of the memory of reproaches having this sexual origin; in other words, that the memory of the sexual action itself, being repulsive or abhorrent, is suppressed, but the feeling associated with the memory persists in the mind and now associates itself with or attaches itself to some other memory or action, and that in this way arise the various obsessions. Others than myself have dwelt upon the glaring inconsistency of the sexual immaturity of children and the intrinsic biologic improbability of this theory. Perhaps Freud has himself been impressed by this fact, for of late years it would appear that he has retreated to the age of puberty, attempting to save the situation, however, by saying that the memory of these sexual events is projected from puberty into the period of childhood.

It is extremely probable that Freud, by his method, suggests the memories of sexual occurrences to his patients; in other words, that he elicits from them a fictitious memory of sexual events in their childhood, of events that have never occurred. Indeed, Loewenfeld gives an instance of a patient of Freud who subsequently came into his (Loewenfeld's) hands.* The woman stated to him that the sexual events which she had related to Freud when under his treatment had really never occurred. She declared that the whole thing had been a piece of pure imagination.

Finally, it must be added that Freud states that from one-half a year to three years is necessary for the successful treatment of a patient. Such a condition of affairs is most discouraging, especially when we bear in mind that each séance requires one or more hours, and that the séances must be frequently repeated, often daily, if success is to be achieved. As far as I have been able to learn, a measure of success such as would justify so great an expenditure of time has not followed. I need not, I am sure, point out the one remaining objectionable feature of Freud's method, and that is the questioning of patients with regard to their sexual lives. Such questioning must be persistent and insistent, and, aside from the doubtful value of the results obtained, must be painful and offensive alike both to the physician and to the patient. Certainly, in persons of high social and moral makeup, such a séance, if at all possible, must be intensely disagreeable, and if the truth be known, the rehearsal ofs exual details, repulsive and revolting, probably does harm and not good.

TRAUMATIC NEUROSES

It has long been recognized, in the larger number of patients who suffer from nervous disturbances following accident or injury, that these disturbances are purely functional in character. Because of the frequency of accidents on railroads, the symptom-complex resulting from these accidents became known as "railway spine," and was originally believed to be due to such lesions as chronic meningomyelitis. Not only Erichsen, but even Leyden, Westphal, and Erb, advocated this view. Little by little, however, the purely functional character of these affections became recognized; no basis of anatomic change could be discovered.

In brief, the nervous disorders that follow trauma proved to be preëminently neurasthenic and hysterical. Very commonly neurasthenia and hysteria are associated in traumatic cases, the patient suffering from a so-called hystero-neurasthenia. Sometimes the symptoms of neurasthenia alone are present; this, however, is true of a small number of cases only. In by far the larger number, the symptoms of hysteria alone are present. The symptoms of traumatic neurasthenia and traumatic hysteria do not differ from those of neurasthenia and hysteria arising from other causes except in one important particular, and that is the fixed relation which the symptoms bear in the patient's mind to the accident, when the accident involves litigation. Physicians of wide hospital experience are well aware that both neurasthenia and hysteria of traumatic origin, in which the element of litigation is absent, recover, as a rule, very readily and under simple methods of treatment; indeed, quite frequently without any treatment whatever. Exceptions to this rule, of course, occur, but they are infrequent.

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* Loewenfeld: "Sexualleben und Nervenleiden," 1899, p. 195.

Sometimes a profound hysteria develops after a comparatively slight trauma. Very frequently, again, a hysteria which would rapidle subside if litigation were disposed of, persists for many months or even years. The fact that an injury has resulted from a railway or other accident involving legal liability necessitates a closer questioning and more careful taking of records on the part of the physician, not only at his first but at his subsequent visits, than would otherwise be the case. In due course the patient rehearses his symptoms in the consultations with his lawyers, and many times again during the examinations by the medical experts. The patient is thus subjected to a process which fixes the symptoms firmly in his mind; indeed, he is usually made worse by the preparations for the trial, so pernicious is the effect of this constantly made and repeated suggestion. It is noteworthy that if trial be not reached or be for some reason postponed, the symptoms become less marked, and indeed often largely subside until the next date of trial approaches, when they again become more pronounced and often worse than before; indeed, new symptoms sometimes make their appearance. These recurrences are due to autosuggestion, and more especially to the renewed expert examinations and to the renewed consultations with lawyers. The peculiar relation which the hysteria bears to the accident is shown by the history of these patients when their cases have been settled and litigation disposed of. Time and again experts testify upon the stand that a prolonged course of rest treatment is necessary to restore the patient to health, and yet the experience of the writer, extending over a quarter of a century and embracing many hundreds of cases, fails to reveal a single instance in which, subsequent to the settlement of a case, a rest treatment was carried out. In other words, these patients recover when the element of litigation has been removed, provided they are let alone. The instances in which they consult physicians subsequent to settlement are very rare. It is only when the plaintiff has suffered an injury other than hysteria that after-attendance by physicians occurs. It can be stated as a scientific fact that in the vast majority of cases all treatment ceases with settlement, the symptoms disappearing and the patient forgetting all about them. In confirmation of the intimate relations existing between the trauma and the symptoms in the patient's mind, I may make this final statement, and this without fear of contradiction: that these patients neither get well nor improve, no matter what treatment is adopted, as long as the case remains unsettled or as long as there is any hope of settlement.

Among unusual claims made by hysterical patients is that occasionally of vesical incontinence. True vesical incontinence never occurs in hysteria. When incontinence is present, it is purely psychic and semi-voluntary. Careful watching and examination of the clothing or the bedding of the patient usually clear up this matter. It is further a remarkable fact that a large number of cases of traumatic hysteria complain of sexual disturbances. Men complain of incompetence or of some abnormality, such as pain in the performance of the act. Women complain of their inability to receive their husbands, and that coition is attended by suffering. How great a field there is here for gross misstatement and wilful deception need not be pointed out, and it goes without saying that it is impossible either to verify or to disprove the assertions made. However, it has on one or more occasions occurred in the experience of the writer that during the long delays pending trial, pregnancy and childbirth have occurred in the instance of married litigants who had claimed to have been made impotent by their injuries.

The treatment of traumatic neurasthenia and traumatic hysteria is obviously the settlement of the claim, the cessation of litigation; at least it is the first step in the treatment. Without it nothing can be accomplished. If hysteria alone has been present, nothing further will be required. If a neurasthenia, profound in character, has followed the accident, rest methods might be employed; the writer, however, has never met with an instance in which treatment was subsequently carried out; obviously, it was never necessary.

HYPOCHONDRIA

Hypochondria is a neurosis which, while not as frequent, is relatively as important as neurasthenia or hysteria. It is often mistaken for the latter affections and at times even for melancholia. Physicians are not wanting indeed who regard hypochondria as a stage or form of melancholia. However, hypochondria presents a characteristic clinical picture of its own. It is an affection in which there is present a constant sense of physical ill-being without there being any symptoms whatever of actual visceral or other physical disease or functional disturbance. There are never any discoverable lesions and no functional changes save such as are so slight and unessential as to offer no explanation of the patient's condition. The patient experiences a sense of not being well, a sense sometimes slight but usually so vivid and pronounced as to dominate for the time being his life and actions. There is never, as in melancholia, psychic depression with ideas of sinfulness, spiritual ruin, or moral unworthiness; least of all are there any traces of the delusion of the unpardonable sin. In hypochondria the patient's ideas relate solely to his body. It is the health of the body which alone concerns him, and further there is nothing approaching the wave-like course presented by melancholia.

In health the sense of physical or organic well-being directly affects the psychic state of the individual. It dominates, as it were, his mental tone, and so long as the sum total of the organic impressions is normal, an average degree of well-being is experienced. In this condition the mental attitude is objective, but if the organic sense be disturbed, so that a feeling of ill-being is produced, the mental attitude becomes subjective and the individual becomes introspective. Like hysteria, hypochondria, presents a position midway between mental and nervous diseases. Like hysteria, it is a psychoneurosis. Not infrequently it is hereditary, or neuropathic factors are met with in the family history. It is more frequently seen among men than among women, and is more commonly met with among those who are unmarried. It occurs more frequently before forty than afterward, though it is also seen in middle life.

While we know little or nothing of its intrinsic pathology, we know that causes which depress the nervous nutrition, as well as habits of unphysiologic living, favor its evolution; *e. g.*, sedentary occupations, excessive or insufficient food, idleness, physical indulgences, the abuse of alcohol and tobacco and other nervous stimulants. Many cases occur among clerks, students, and professional people who lead inactive lives. On the other hand, it is also met with among individuals who live out-of-doors, as farmers, laborers, and other persons who make their living by manual labor; here the monotony of life, the daily sameness of existence, may be the active cause. The underlying neuropathy of hypochondria is now and then revealed in the person of the patient. He may be delicate and neurotic in appearance; more often his physical development is good and his appearance in direct contradiction with the grave and manifold illnesses of which he complains. It is noteworthy, however, that he lacks ability and energy, that he does not finish work which he has begun, that he lacks the sustained momentum to carry projects to a successful conclusion. Not infrequently such persons are quite successful in their early lives, but become incapables toward middle life, when hypochondria, fastens itself upon them. Intellectual development and education play no rôle in hypochondria, for the latter may occur alike among laborers and scholars. Space will not permit of extensive consideration of symptoms. Suffice it to say that such a person is usually mindful of his health. He is constantly afraid of becoming ill, of catching cold, acquiring serious disease of the chest, or it may be of the bowels. It is quite a common experience for such a patient to present himself for examination before a physician while wearing an excessive amount of clothing. Often also these patients are peculiar in regard to their food. Not infrequently they adopt a special dietary, to which, however, they adhere for a limited time only; for a time it is an exclusive vegetable diet, and again it is a diet containing a disproportionate amount of meat. Now it is abstinence, then full feeding, and again Fletcherism. Quite commonly a special dish or class of foods is affected or excluded. Now it is cereals, breakfast foods, special kinds of bread, which are favored, and again it is fruit and vegetables. Sometimes an article of food favored at one time is tabooed at another.

The patient is apt to complain of various subjective symptoms, such as pains or pressure about the head, pains in his limbs, or of vibratory, trembling, or numb sensations, or it may be of fullness and pressure over the stomach or over the bowels. Distressing sensations which he explains by a disorder of the liver, kidneys, or heart may also be complained of; not infrequently they consist of vague sensations which he cannot adequately describe. Physical examination fails to reveal physical signs of moment. The neurologic examination is negative. Now and then a coated tongue, some evidences of gastro-intestinal atony or catarrh, together with constipation, are noted. Quite commonly, however, these symptoms, if present, are slightly, if at all, marked. Sometimes a slight catarrh of the head or of the throat is noted, and when a knowledge of such catarrh is possessed by the patient, it becomes a fruitful source for hypochondriacal ideas. Beyond slight indigestion and constipation, no visceral or somatic signs can, as a rule, be detected. Now and then a coldness of the hands and feet or slight lividity of the surface or other slight circulatory disturbance is noted.

Quite commonly such patients note carefully their various symptoms; especially do they study their bowel movements, and at times also the urine. If the latter be phosphatic, it becomes a fruitful source of nosophobia. Not infrequently the patient keeps a record of his symptoms, and it is quite a common experience to have him enter the physician's office, seat himself, and then draw forth slips of paper on which he has noted a multiplicity of symptoms, symptoms usually subjective, always trivial and unimportant, and generally incapable of verification. In manner and bearing, the hypochondriac suggests a person gravely oppressed by illness. He frequently presents the history of having visited physician after physician in a vain attempt to obtain satisfaction as to his condition. The various diagnoses of his case that have from time to time been formed are carefully preserved by him, and serve to convince him that he is really a very sick man. At times he reads medical books. At other times he makes his own diagnosis and then goes to the physician with his diagnosis already prepared. Finding little or no satisfaction from visiting physicians, he may begin to treat himself, and he then becomes a prey to numerous proprietary and patent medicines. As a rule, one can find in the closets and drawers of such a patient a collection of pills, powders, and bottles. He is usually taking medicine of somekind or other. Today it is medicine for his stomach and bowels, tomorrow for his liver and kidneys. It is not surprising that his habits should be peculiar. Either he does not exercise at all or he exercises excessively. Frequently he adopts special systems of exercise, first one and then another, each being followed for a time, only to be rejected. He is apt to entertain equally varying views with regard to bathing, ventilation, and clothing. The point is that he is always concerned with the care of his person. He becomes readily alarmed about himself. The discovery of a new or supposedly new symptom or some other trivial occurrence at once enhances his hypochondria.

Hypochondria does not always pursue an even course. The attitude of mind may at one time be more pronounced than at others.

Sometimes actual remissions are noted. In some cases a permanent and spontaneous recovery takes place. In others the hypochondria fades away with increasing years and ultimately disappears. Especially is this true with the hypochondria which has its inception in youth or early adult life. Young hypochondriacs offer relatively favorable prognoses unless the neurosis has made its appearance in childhood. In such instances marked neuropathic factors are usually quite evident. The prognosis is also relatively unfavorable in those cases in which there is a family history of hypochondriasis or a family history of insanity. Acquired hypochondria offers a somewhat better prognosis, provided the etiologic factors, such as sedentary habits and other habits of unphysiologic living, can be corrected. The hypochondria which makes its appearance in the middle period of life is relatively unfavorable, save that as old age approaches it gradually fades and becomes less marked. It is a remarkable fact, further, that throughout the course of hypochondria the mental faculties are clear, well preserved, and suffer no degradation. It is very rare that a case merges into mental failure.

In addition to a hypochondria general in its character, we may distinguish two forms: in one, the gastro-intestinal form, the patient complains of distressing sensations referred to the abdomen or to the digestive tract; there may be present some atonic indigestion, perhaps also slight gastric catarrh and constipation, but the statements of the patient as to his suffering are out of all proportion to the symptoms. The second is the sexual form of hypochondria. This is more common in young men. Its victims frequently believe themselves to be impotent. Quite commonly they are persons who have never attempted the sexual act and are engaged to be married. As a rule, when marriage takes place they prove to be entirely normal. Every now and then, however, this is not the case. The fear and nervousness, and especially the belief that impotence exists, lead to failure. The sexual organs, it is not necessary to say, fail to reveal any abnormality. Not infrequently, the belief in sexual impotence is based upon a previous masturbation, even when the latter has been slight and insignificant. At times, again, it is the occurrence of emissions which forms the nucleus around which the hypochondria centers. Sometimes the emissions are excessive, but usually they are quite normal in their frequency.

The indications for treatment are, unfortunately, not so clear as in the cases of neurasthenia and hysteria. It does not answer the purpose to explain to the patient that he suffers from a purely imaginary disease, that he is not ill, and that he merely believes himself to be ill. As a matter of fact, the patient is really ill—ill from a very troublesome affection. The wisest course is not to dispute the reality of the condition, but to point out to him the functional character of the symptoms and the entire absence of organic disease. Especially is this course valuable if, previous to expressing such an opinion, the physician has made an elaborate physical examination. Hypochondriacs like to be examined, and one of the most common grievances of which they complain is that no one will listen to them, that no one will take time to examine them properly.

The question of treatment is the application of physiologic measures and, if necessary, the correction of special symptoms. At once the question arises shall we apply rest, and if so to what extent. Rest treatment, especially systematic rest in bed, should be but rarely employed in hypochondria. If employed at all, it should be applied in the partial method only. The object of the treatment should be to raise the general health to as high a level as possible, and it is essentially a problem of physiologic living and physiologic therapeutics that confronts us. Occupation is here, as a rule, of inestimable value. Work, mental and physical, means the active stimulation of function, and as a corollary a relatively higher level of health. Work, too, necessitates an objective mental attitude, and the patient devotes less and less time to the consideration of his symptoms. A high degree of activity, if it can be brought about, means for him a relatively high degree of health; and, in fact, he is often at his best when under full pressure. Of course, in the beginning of a treatment, or if due to the patient's unphysiologic habits there be an actual impairment of health, rest methods may be employed, but they should consist only of partial methods, and as the general health improves the time devoted to active exercise and active pursuits must be increased and the performance and discharge of the patient's duties must be rigidly insisted upon. There is no impropriety, of course, in the application of hydrotherapy, of massage, of electricity; but in every possible way the physician should refrain from confirming in the patient's mind the idea as to the seriousness of his illness. Every hour of the day should be filled, and in every way the active interest of the patient in his business should be stimulated. The aim is, of course, to give the patient as objective an attitude of mind as possible.

THE NEURASTHENOID STATES (THE PSYCHASTHENIAS)

Under the term of psychasthenia, Janet has embraced the states which were at one time classed under the general term of the neurasthenic insanities, and which the writer has at various times described under the general term of the neurasthenoid states. A psychasthenia is an affection in which a person suffering from a neuropathy, usually hereditary, is also the victim of a nervous exhaustion; that is, there are present in a psychasthenia two factors: first, a more or less pronounced neuropathy, and, secondly, exhaustion. By virtue of the neuropathy, the symptoms presented by the exhaustion assume a special character and differ from those met with in ordinary neurasthenia. A brief illustration will make my meaning clear. As pointed out in the consideration of neurasthenia (see p. 858), a neurasthenic patient may suffer from attacks of spontaneous generalized fear. If, besides being neurasthenic, the patient has the misfortune to be also neuropathic, that is, if there be present, in addition to the neurasthenia, the elements of a nervous degeneration, hereditary, congenital, or acquired, the attack of fear may assume a special character. A pathologic association may be formed in the patient's mind with the environment or other circumstances attendant upon the attack; the emotion of fear may become definitely related to such environment or circumstances, so that whenever the environment or circumstances are reproduced, these alone may evoke a recurrence of the fear. Thus, a neuropathic neurasthenic patient may have an attack of spontaneous fear while he happens to be alone. At subsequent times, the mere fact of being alone may of itself induce an attack of fear; the symptom arising under such circumstances is known technically as monophobia, the fear of being alone. Similarly, other forms of fear, such as agoraphobia (fear of open spaces), claustrophobia (fear of narrow or closed spaces), and other special fears too numerous to mention may arise. In a similar manner, other obsessions are formed; thus, a normal neurasthenic loses, as a result of his overfatigue, his usual readiness of decision. It takes him longer than formerly to decide ordinary matters; he cannot form a conclusion as rapidly or as readily. In a neuropathic subject this indecision may become so pronounced as to lead to the formation of a true insanity of indecision, a *folie de doute*. Again, a normal neurasthenic loses somewhat in personal force or will power; the neuropathic subject may, under exhaustion, suffer loss of will-power to an extreme degree, so that he may be unable to perform simple and accustomed acts; thus, a clergyman may be unable to ascend his pulpit, an actor unable to take up his cue; such a symptom is termed abulia. The normal neurasthenic also presents some impairment of self-control, of inhibition, that is, he becomes irritable, impulses are eliminated too readily, are not dominated or controlled as in health; weakness and irritability go hand in hand. Deficiency of inhibition in a neuropathic neurasthenic may result in the elimination of special gestures, exclamations, words, or phrases which the patient is utterly unable to prevent; *i. e.*, such a patient may develop psychomotor tics, the various tics which the French term tic convulsif. These movements, which suggest often voluntary actions, may consist of bowing movements, special gesticulations, the interlarding of speech with inappropriate exclamations, oaths, and, at times, of obscene expressions. The more pronounced the symptoms, of course, the more pronounced is the neuropathy. Special tricks of gesture, special words or phrases, having once found ready utterance in the neuropathic neurasthenic, the same acts subsequently find expression with greater and greater ease, until finally they are utterly beyond the patient's control. This symptom, which is really one of defect of inhibition, developed in a neuropathic subject by fatigue, is often spoken of as insanity with irresistible impulse. Space will not permit of a more extended consideration.

The neurasthenoid affections, the psychasthenias, unfortunately do not offer an encouraging outlook. However, every possibility in the way of improving the general health of the patient should be employed. Not infrequently, especially if the psychasthenia has been of relatively short duration, full rest methods, full feeding, massage, bathing, exercise, etc., together with simple psychotherapeutic procedures, such as gradual retraining and reëducation, are followed by gratifying results. Systematic exercises, especially those necessitating attention, and careful muscular coördinations are of special value. If the psychasthenia has lasted for many years, little, as a rule, can be accomplished. In regard to the various psychotherapeutic measures to be employed, the reader is referred to page 887. What has been said as to the application of psychotherapy to hysteria applies equally to the application of psychotherapy to psychasthenia, save that in psychasthenia the results are far less gratifying. Psycho-analysis is occasionally of some value here. If the patient is able to unfold fully the details of the first attack of a special fear or of such other obsession as he may have, the pathologic associations which he has formed may be broken up. If any result can be gained, it can be achieved in a single interview. Frequent repetition does harm and often defeats the end in view. However, it does not require three years, nor are we to search for forgotten facts of sexual aggression or assault. (See p. 889.)

A point of practical value is that, in a given number of cases, minute doses of thyroid extract, long continued, are apparently of benefit. A possible explanation may be found in the fact that every now and then in psychasthenia, more especially in cases presenting indecision, there are present symptoms of myxedema. These symptoms, while usually not typical in degree, are yet so evident, as to be unmistakable.

HEADACHE

Headache, as the word implies, is the name merely of a symptom and not of a disease. However, it is a symptom so frequently complained of and the pivotal point of so many affections that it requires a separate consideration. The term, as used both by the laity and medical writers, is of wide application. It becomes absolutely necessary, therefore, before entering into a consideration of treatment, to discuss the various forms of headache both from the standpoint of etiology and of diagnosis, for without a correct diagnosis and without correct views of etiology the treatment is often an impossible task.

Pains referred to any part of the head are apt to be spoken of as headache, even though this pain have its seat in structures external to the skull. This is the case notably with some forms of rheumatic and syphilitic headaches. Rheumatism of the scalp, for instance, is by no means an infrequent affection, and if it involves the occipital region, it may be associated with rheumatism of the muscular insertions of this region. Such pain may be very distressing, and if unrecognized may go unrelieved. It is very apt to be mistaken for the occipital headache so commonly met with in neurasthenia. It is distinguished by the fact that there is marked tenderness of the scalp to touch or to the hair-brush, and, if it be situated in the occipital and nuchal situations, there is the associated symptom of pain made worse by motion. Similarly, the scalp may be the seat of gummata which may either be painful to touch or which may give rise to severe and persistent headache, worse at night. Syphilis, as is well known, may also involve the periosteum and bones of the skull. Usually the symptoms are such as to permit of a ready diagnosis. The treatment of rheumatism of the scalp is, of course, that of rheumatism in general, and does not merit special discussion; this is also the case of syphilis of the scalp, cranium, periosteum, and skull.

In a general consideration of headaches it becomes necessary to make a distinction between headaches due to organic changes and headaches that are purely functional in character. Headaches due to organic causes are such as would be produced by an inflammation of the dura, by a depression of bone irritating the dura, or by gross disease, such as brain tumor; organic headaches are, of course, associated with demonstrable lesions. They are usually distinguishable from non-organic headaches by the fact that they are constant or persistent. We should bear in mind, however, that organic headaches may fluctuate somewhat in intensity. It not infrequently happens, even in so grave an affection as brain tumor, that the headache is somewhat less at times than others. Indeed, the relief experienced may be so great for short periods of time that the patient may even speak of the headache as being absent. However, headache is usually so persistent a symptom, so constantly spoken of by the patient, that even if the fact of fluctuation in intensity be observed, this fluctuation must not be regarded as militating against the diagnosis of organic headache. Further, organic headaches are likely to be associated with other very pronounced symptoms. Thus, in brain tumor, we are apt to have vomiting and dizziness, frequently optic neuritis, and in a very large number of cases the so-called focal symptoms—localized convulsions or palsies, special sense and speech disturbances, or other signs which point to some one region of the brain. Again, in headache due to intracranial syphilis not only have we the peculiar history of the headache being worse at night, somnolence or other sleep disturbances, but also the associated palsies, unequal pupils, involvement of ocular muscles, and other signs pointing unmistakably to a brain syphilis.

A discussion of the organic headaches would involve a discussion of the various diseases of the dura and of the brain already discussed in other portions of this volume. As far as we are concerned, the question of organic headache is important only as regards their recognition; that is, their separation from the functional headaches. The organic headaches, let us repeat, are characterized first by being continuous, by the co-existence of sleep disturbances, nausea, vomiting, and by the association of gross physical signs pointing directly to gross lesions, general or focal in character.

FUNCTIONAL HEADACHES

A consideration of the various forms of headache leads to the following useful grouping: Thus, we have, first, the headaches associated with the great neuroses—(*a*) neurasthenia; (*b*) hysteria; secondly, headaches of diathetic, toxic, and infectious origin; thirdly, headaches symptomatic of affections of the special sense organs, such as the eyes, and the various viscera; and, fourthly, headaches associated with various diseases of the blood.

Neurasthenic Headache.—The headache of neurasthenia, as already pointed out, is, as a rule, a dull, diffuse pain or ache, which in its milder forms suggests merely a sensation of fatigue. It may, however, become pronounced and even then may be nothing more than an exaggerated fatigue sensation which disappears upon rest. It is usually described by the patient as a dull feeling in the head or as a dull aching. As a rule, it is not diffused over the entire head, but is seated in the occiput, in the upper part of the neck, over the brows, or just over the eyes. The occipital pain is, however, by far the most frequent. Other situations are occasionally described by the patient, such as the sides of the head and the temples. Very commonly the pain is accompanied by a sense of pressure or constriction, these sensations either being referred to the sides of the head (the patient often saying that he feels as though a tight band had been placed around his head) or it is associated with pressure and drawing sensations at the back of the neck. Sometimes, instead of sensations of drawing, pressure, or constriction, other sensations, such as heaviness or throbbing, are described. Neurasthenic headache, when mild, disappears upon the mere cessation of work. The average statement of the patient is to the effect that mental effort brings it on or, if it be already present, leads to exacerbations.

It need not be here stated that in a patient presenting neurasthenic headache the other cardinal symptoms of neurasthenia are also present. (See p. 858.) Thus, we have the statements of the patient relating to ready fatigue and exhaustion, the associated symptoms of backache, limbache, and the various digestive, circulatory, and sleep disturbances so commonly met with. The diagnosis of a neurasthenic headache, therefore, resolves itself into the diagnosis of neurasthenia, while its treatment is the treatment of neurasthenia.

Hysterical Headaches.—It not infrequently happens that a patient, most frequently a woman, presents herself complaining of headache. Very frequently the statements in regard to the headache are couched in such terms as to suggest exaggeration, while the appearance of the patient is such as to negative the existence of really serious suffering. If asked to indicate the site of the pain, the patient is very apt to point to a small circumscribed spot or area with her finger. If, now, this area be examined, it is found to be very sensitive to superficial pressure. At the same time, the patient is apt to describe it as a pain which is deep and boring, or as though a knife were being driven into the head; this has given rise to the well-known term of clavus for the symptom. Sometimes other symptoms secondary in importance are also complained of by the patient, such as ringing or throbbing noises in the ears; sometimes she says that she feels as though the head were being beaten with a hammer. Clavus is merely to be regarded as an area of painful cutaneous hyperesthesia; other sensory stigmata of hysteria should at once be sought for. Especially should the patient be tested for the typical painful stigmata beneath the breasts and over the groins and elsewhere, bearing in mind, other things equal, the predominance of these signs upon the left half of the body. The treatment is, of course, the treatment of hysteria. (See p. 878.)

Diathetic Headaches.—Headaches are not infrequently complained of by patients who are the victims of the gouty or rheumatic diathesis. The diagnosis is to be made by the presence of other symptoms pointing to these affections. Like other affections of this character, they are more frequently found in persons who have passed middle life, and in whom there is a history of exposure or deprivation or of excessive eating or drinking. Hereditary factors should also, it is needless to say, be inquired into. The headache of uremia and of diabetes need only be mentioned as instances of other headaches associated with diathetic conditions, the recognition of which, other things equal, should be prompt. Uremic headache, while diffuse, is most pronounced in the occiput, extending to the neck. At other times, again, it is frontal. Dizziness may also be present. The patient is frequently dull and apathetic. An examination of the urine, of course, leads to the diagnosis. Diabetic headache, usually associated with delirium, sometimes with cyanosis, may precede the onset of diabetic coma. Headache of diabetic origin is, on the whole, a rare symptom. Its association as a part of the symptom complex, of course, determines its diagnosis.

Toxic Headaches.—Among toxic headaches we should especially bear in mind headaches of alcoholic origin. The headache complained of by chronic alcoholic subjects is, as a rule, widely diffused, dull in character, and more pronounced in the frontal regions than elsewhere. It is, as a rule, more marked in the mornings. It is more pronounced after unusual excesses. It is, of course, associated with the other symptoms of chronic alcoholism. Headache due to lead is not met with save as prodromal to and associated with other and more pronounced cerebral symptoms, such as delirium, convulsions, and coma. Optic neuritis or neuroretinitis may also be observed. In the investigation of an obscure case of headache the abuse not only of tobacco, but of tea and coffee, should also be borne in mind. No difficulty, as a rule, is experienced in tracing headaches such as these to their proper cause. An inquiry into the habits of patients is usually very fruitful of results. Care should, however, be taken to prevent confusion of these headaches with migraine. (See p. 903.) Tobacco headaches generally occur at irregular intervals, even in the confirmed users of tobacco, and then bear a relation to some unwonted excess. Like the headache due to alcohol, it is widely diffused and usually frontal.

Headaches from Infection.—The headaches associated with the various infectious diseases require only a passing mention, inasmuch as their association with other well-known symptom groups at once determines their nature. They neither require nor is it practicable to give them detailed consideration here.

Headaches Symptomatic of Affections of the Special Sense Organs, such as the Eye and the Various Viscera.—Closely allied to the neurasthenic headaches are headaches associated with functional troubles of the eyes, of the stomach, and of other viscera. Of these, none is so frequent as that due to overuse of the eyes; that is, to eye-strain. There can be no question, however, that eye-strain as a direct cause has been much overestimated. Almost always there is an associated and underlying condition of nervous exhaustion, so that any effort is followed by headache or by an exacerbation of headache. It is not surprising, therefore, that in neurasthenic states we should find that the use of the eyes brings on headache; especially if the eyes present marked difficulties of refraction and accommodation, so that their use is unavoidably attended by considerable effort. The headache in these cases is usually occipital in character and indistinguishable in its general character from that present in neurasthenia. More rarely it is frontal. It is always made worse by the use of the eyes. It is important, of course, to have the latter carefully examined, and to have their defects as far as possible corrected by proper glassing. Very frequently, however, this correction fails to relieve the headache, though it may ameliorate it. In many instances a treatment directed to the underlying neurasthenia is the only method by means of which a genuine relief can be secured.

Pains referred to the brow, to the temples, or to the malar regions are not infrequently the outcome of disease of the nasal cavity or sinuses. In the majority of cases the nasal or sinus symptoms are so prominent as to attract attention. In others they are comparatively slight, and the true cause of the pain may remain undiscovered unless it is specially sought for. In all obscure cases, with or without aching pains in the brow, the malar regions, or in the temples, the nasal cavities and sinuses should be thoroughly explored.

Various functional disturbances of the stomach and bowels are also associated with headache. Especially is this likely to be the case if there be present a chronic gastritis. Gastric headaches are more frequently frontal, though they may be referred to the convexity or may be generalized. As a rule, the headache is most pronounced when the signs of indigestion are most evident. Frequently such headaches are relieved by vomiting. The possible influence also of the absorption of toxic substances must here be borne in mind. Headaches due to stomach disturbances are, on the whole, infrequent.

Now and then atonic conditions of the bowel are accompanied by headache. A familiar instance is the headache which attends constipation and which is relieved by free evacuation. Headaches which accompany uterine and ovarian disease are also recognized. The pain is, as a rule, referred to the vertex, and is frequently relieved, temporarily at least, by pressure on the top of the head. It is, of course, accompanied by the symptoms of pelvic disease, and is secondary in importance and in value. It is important, further, to add that the patient almost always suffers from an associated neurasthenia. Indeed, I think that it may well be doubted whether a headache, directly dependent upon uncomplicated pelvic disease, really exists.

Headaches Due to Anemia and Hyperemia of the Brain and Diseases of the Blood.—A generation ago it was quite common to ascribe headaches to anemia and hyperemia of the brain. It was only after neurasthenia became well understood that the diagnosis of cerebral anemia ceased to be made. That cerebral anemia presents itself as a natural and pathologic entity there can be no doubt, but it does not present itself by any means with that degree of frequency which the older physicians thought. Finally, it may well be doubted whether head pain constitutes a symptom, or at least a prominent symptom, of cerebral anemia. In acute general anemia from hemorrhage the symptoms are those of failing vision, "blackness before the eyes," faintness, and a feeling of being dazed or confused, tinnitus, nausea, and vomiting; if the anemia be profound, lethargy, a tendency to sleep, unconsciousness with dilatation of the pupils, may finally supervene. Head pain at no time forms a part of the clinical picture. In the chronic anemia which results from frequently repeated hemorrhages we may likewise notice a tendency to faint, dizziness, somnolence, or at times insomnia, apathy, and tinnitus.

Cerebral hyperemia as a cause of headache has suffered an almost similar fate. Transient attacks of cerebral hyperemia, however, probably occur; as, for instance, due to increased action of the heart in febrile conditions, sudden chill, etc. Whether it occurs in association with plethora is doubtful, and yet this seems very probable when one remembers the condition of intense congestion of the face which sometimes comes on in a plethoric person after a full meal, especially if taken with alcohol. Such a patient may complain of throbbing in the temples, great fullness of the head, headache, and dizziness. Unquestionably also hyperemia occurs passively in general venous obstruction, as in mitral stenosis, emphysema, pressure on the superior vena cava by aneurisms and tumors, or from localized obstruction in cerebral sinuses or veins. It probably occurs also during tremendous muscular efforts. Headache associated with hyperemia is clearly secondary in its origin. It can hardly come under the notice of the physician as an independent cause of headache.

Furthermore, in diseases of the blood, such as chlorosis, pernicious anemia, and leukemia, symptoms similar to those noted in anemia are present. Headache, on the other hand, is rarely noted, if at all.

MIGRAINE

Migraine is a nervous affection characterized by severe attacks of headache, recurring at irregular intervals. The pain is, as a rule, limited or markedly accentuated upon one-half of the head; hence the name, hemicrania. The individual attack is usually preceded, though not always, by distinct prodromata. Sometimes the patient suffers from a sense of heaviness in the head, pressure over the brows, or it may be dizziness. At other times there is present a sense of weakness and depression, or the patient may feel sleepy, may yawn repeatedly, or may wish to lie down. In many patients there is noticed a more or less marked impairment of vision, usually involving a part of the field only; at times a hemianopsia is simulated. Frequently also vibrating scotomata are observed, or the blind field is filled with quivering lines, sometimes of dazzling brightness. At other times an attack is preceded by a tinnitus, or it may be some paresthetic disturbance of the side of the face, or obscure sensations may be noticed in an arm, a hand, or more rarely in lower extremity. Rarely distinct paralytic phenomena are observed, such as a weakness of a hand or wrist.

After a variable period of time—a few minutes or a fraction of an hour, the pain begins. It is at first dull in character, accompanied by a sense of heaviness in the head. It gradually increases in intensity. Sometimes it remains limited to a comparatively small area of the temple. At other times it radiates over the entire area of the top of the head or of the face. Again, instead of the focus of the pain being situated in the temple, it may be found back of the ear. It gradually increases in intensity until usually, after several hours, an acme of suffering is reached. Not infrequently nausea supervenes and at times vomiting ensues. Subsequently, the pain subsides, and the patient is apt to fall into a sleep which is usually quite profound and lasts several hours. On awakening the patient is generally free from pain; the attack is over.

In the beginning of the attack various vasomotor disturbances may be observed. Thus, there is not infrequently flushing of the side of the head and face which is affected, a flushing which is succeeded by pallor as the attack progresses. At other times, too, distinct changes are noted in the pupils, the pupil of the affected side being at one period dilated and later on contracted. Marked pupillary changes are not, however, by any means observed in all cases, and this is likewise true of the vasomotor changes in the face. The duration of an attack usually extends over a number of hours; sometimes over the greater part of a day.

The frequency of recurrence differs greatly in various cases. Quite commonly we have a history of a migraine beginning in childhood or youth, the attacks being then many weeks and often months apart. Little by little the interval becomes shorter, until an attack occurs say once in two weeks, once in a week, or perhaps several times in a week; or the attacks may succeed each other so rapidly that a scarcely appreciable interval is to be found between them. Indeed, migraine headaches, when long established, are in some individuals practically continuous. At times, also, the headache is not unilateral, but is marked upon both sides of the head, sometimes equally so, constituting then a so-called double hemicrania.

In severe cases, when the attack is at its height, the patient is exceedingly sensitive to light and noise. At times there is also marked sensitiveness on the affected side of the face and scalp to touch. Movement, too, adds greatly to the suffering.

Migraine is today regarded as a degenerative neurosis. Hereditary elements are present in a very large number of cases. According to Moebius, 90 per cent. of cases furnish a direct heredity. Quite commonly it begins at or about the period of puberty, though it at times makes its appearance in childhood. It rarely begins after thirty. Quite usually it becomes less marked as middle age is approached; not infrequently it disappears altogether at this period of life, or persists in a greatly modified and lessened form, such as the occasional occurrence of vibrating scotomata without the subsequent occurrence of pain.

While the essentially neuropathic and hereditary factors of migraine must be admitted, it must also be borne in mind that its attacks may be directly provoked by various exciting causes, such as excesses with alcohol, tobacco, tea, and coffee, or by emotional or mental overstrain, shock, overwork, and especially overfatigue of the eyes.

Many facts point to an important rôle played by the vasomotor apparatus, and others suggest defective tissue metabolism, defective elimination of waste substances,—the alloxuric bodies,—and consequent autointoxication, as causes. Indeed, it appears to bear a distinct relation to the gouty diathesis, as was long ago pointed out by Charcot and by Gowers.

In the treatment of migraine three important considerations must be borne in mind: First, attention must be given to the general health of the patient. This must be brought to as high a level as possible, and to this end no means are so efficacious as those embodied in general physiologic and hygienic measures. It not infrequently happens, especially if the attacks have occurred with great frequency or been almost continuous, that the general health has greatly suffered. Migraine is not infrequently at such times complicated with neurasthenia. As far as possible such a patient should be relieved from the strain of his occupation. Rest methods in some form, partial or even complete, should be instituted. (See section on Neurasthenia.)

In a large number of persons suffering from migraine it is impracticable to institute absolute rest, and, indeed, this is not by any means always required. It will frequently suffice to institute partial rest methods (see p. 865), but this should be carried out as rigidly in the intervals between the seizures as during their occurrence. It is especially important to modify the diet, as in neurasthenia, with the view of minimizing the waste substances, notably those of the uric acid group. With this object in view the carbohydrates, the starches, and sugar-containing foods should be reduced to a minimum, but not, of course, absolutely withdrawn. The same is true of the red meats. Their rôle in favoring an excessive formation of uric acid is well known, and whatever view we may hold as to the relationship between uric acid and migraine, experience proves that migraine patients do better upon a diet which contains only a moderate amount of red meat. The white meats, chicken, fish, oysters in season and properly prepared, eggs, milk, and the succulent vegetables can be freely given. The milk especially is a most important article of diet, and it is a not uncommon practice with the writer in case of severe and obstinate migraine to place the patient exclusively upon a diet of milk for a time. Milk has the double advantage, while it is nutritious, of being unstimulating, and at the same time, because of its liquid nature, greatly favoring elimination. An important point in regard to diet consists also in instructing the patient as to the amount of food he is to take. Full feeding is in many of these cases of the very greatest value. The diet should first be regulated as regards the kinds of food; secondly, the quantity should be steadily increased, especially as regards the milk, until a maximum amount is taken. In addition, it is wise also to instruct the patient to drink freely of water, especially in the intervals between meals.

Attention must also be given to the skin. The patient should bathe freely. A tepid sponge bath or rapid immersion bath should be prescribed daily. The bath should be followed by vigorous friction. In some cases it may be of advantage to order a cold immersion bath daily, but not infrequently the sufferer from migraine is exceedingly sensitive to baths of this kind and does not react well from them.

As far as possible, errors of digestion should be corrected. Atony of the stomach, constipation, gastric catarrh if it exists, as is not uncommonly the case, should also receive their due measure of attention. As regards the constipation, it is wiser, in case of migraine, to use some mild saline or laxative water rather than to rely upon a vegetable laxative or cathartic. Phosphate of soda, especially in the effervescent form, is a valuable remedy in these cases. The Carlsbad salts, Hunyadi, and similar laxatives answer an equal purpose. It is exceedingly probable that the saline stimulates elimination by the bowel, and it is a not uncommon experience to find that a beginning migraine attack is frequently aborted by a saline, taken as soon as prodromal symptoms are noted.

As far as possible, the patient should be instructed to live in the open air. Gentle exercise is of the utmost value under these circumstances. One of the cardinal benefits of exercise is the increased intake of oxygen which the exercise induces, and the consequent more thorough oxidation of the waste products and their more ready elimination. By all the means at our command, then,—by proper proportioned rest and exercise, by a carefully adapted diet, by stimulating the activity of the kidneys, bowels, and skin,—the general health of the patient should be improved.

Whether it be advisable, in view of possible autoinfection through the intestinal tract, to give intestinal antiseptics, such as beta-naphthol, remains an open question. The writer has never found them of the slightest use in migraine. Bearing in mind, however, not only the possible, but also the very probable, rôle of the purin bodies in migraine, the writer has for years past treated cases of migraine, especially when obstinate, by means of the salicylates. He has been in the habit of administering sodium salicylate, preferably in combination with sodium bromid, in moderate doses, for a period of ten days or two weeks, with undoubted benefit as regards both the frequency and the severity of the attacks. According to the circumstances, from five to ten grains of sodium salicylate, associated with ten or twenty grains of sodium bromid, should be administered, well diluted, three times daily after meals. The remedy is, as a rule, well borne by cases of migraine, and unquestionably is followed by good results.

In many cases the sodium salicylate is not well borne, and it is then wise to use aspirin, or, better still, novaspirin freely, say in fifteen-grain doses three or four times daily. Rarely, because of the condition of the stomach, it may be wise to give salophen. This may be employed in similar or somewhat larger doses. It is always well borne by the stomach, but is less efficient than the other remedies.

The treatment of the attack itself requires special consideration. It is wisest to instruct the patient, just as soon as prodromata are noted, to take a saline; the dose, guided by previous experience, being such as to give rise to two or three loose movements. A full dose, say thirty or possibly forty grains, of bromid, preferably ammonium bromid, should be taken some two hours later. The patient should then lie down and compose himself to sleep. In patients in whom it is impracticable to take the bromid, because of the interference with the occupation, recourse may be had to one of the coal-tar products, antifebrin, phenacetin, or antipyrin, the remedy being combined with a moderate dose of bromid, with half a grain or a grain of caffein, or possibly with some aromatic spirits of ammonia. A useful combination is phenacetin, five to ten grains, with caffein, one-half to one grain; at other times ammonium bromid, twenty grains, caffein citrate, one grain, and antipyrin, ten grains, with or without ten or twenty drops of aromatic spirits of ammonia. Far more useful than the bromid and the coal-tar products, the author has found cannabis indica. The patient is instructed to take one drop of the fluidextract of cannabis indica every hour or every half-hour until some relief is experienced. Very soon the amount which the patient requires to control an attack is thus determined experimentally. Sometimes the patient is not relieved until the dose is increased to two, three, five, or ten drops, and sometimes even more. The patient should, however, always be cautioned with regard to the possible unpleasant effects which may supervene when the full physiologic action is established, such as dizziness, slight confusion, and disturbances in the sense of time. However, unusual or unpleasant sensations rarely make their appearance from therapeutic doses. We should be content to begin with small doses and, notwithstanding repeated failures, should steadily increase the dose in successive attacks until an impression is made and the necessary dose definitely determined. In rare cases, usually cases in which the attacks have existed for many years and in which the intervals are so short as to make the headaches practically continuous, we may be forced to abandon cannabis indica; but under such circumstances we may frequently obtain very useful results from gelsemium. This drug should be administered in the form of the fluidextract, in doses of from one to five minims, and repeated if necessary at intervals of four hours. Of late years, since the author has given more attention to the physiologic and hygienic treatment of migraine, and especially since his employment of the salicylates and bromid in the intervals of the attacks, he has experienced but little difficulty in controlling the pain by moderate doses of cannabis indica or by doses of phenacetin and caffein, so small that even their repetition does no harm. Occasionally, cases of migraine of such severity are met with that no method of treatment appears to be of value. Under these circumstances Whitehead has recommended and carried out successfully the insertion of a seton in the back of the neck, the seton being worn for quite a long period. However, the writer has never made use of this expedient.

It goes without saying that while migraine does not result from eye-strain, eye-strain may evoke the attacks. In every case, therefore, the eyes should be examined and if necessary corrected. For similar reasons, the nasal cavities, the sinuses, the ears, and pharynx should likewise be studied and if diseased treated.

VERTIGO

Vertigo is a term applied to a symptom in which the patient experiences a subjective sense of movement or of actual movement accompanied by more or less marked disturbance in, or even loss of, the sense of space relations. The movement may be referred by the patient to his own person or may be projected by him to the external world. The sensation is one of distress, and is attended by a more or less marked disturbance of the equilibrium or of the sense of equilibrium. Vertigo may be entirely subjective or it may be objective; that is, attended by an actual movement of the body. The movement may be very slight or so pronounced as to cause the patient to stagger or even fall. Quite commonly the patient experiences a sensation as though all the objects about him are turning around or that he himself is turning around, hence the term, derived from *vertere*, to turn. The words giddiness and dizziness are both commonly applied to the less marked conditions of vertigo or to forms of vertigo which are almost, if not entirely, subjective.

Vertigo is almost always paroxysmal. The intervals are very irregular: sometimes a few hours, sometimes days and weeks intervene. The attacks may come on spontaneously or may be excited by changes of posture, such as rising from a bed or chair, stooping, or turning; at other times, though less frequently, sudden movements which jar the head, such as coughing or sneezing, bring on the attack.

Vertigo is a symptom which is found in a great variety of conditions and only at times appears as an independent clinical affection; more frequently it is the chief or most distressing symptom of some other affection which is present. It may be a symptom of a general affection such as neurasthenia; here it is usually purely subjective. It may also be met with in toxic states; *e. g.*, from alcohol, tobacco, and coffee and in uremic poisoning. It may be met with, again, in disturbances of the nerve-centers, *e. g.*, the cerebellum; or in disturbances of certain peripheral structures, such as the ears, more especially the labyrinth; or in disturbances of the nerves and nervous tracts which combine these structures with the nerve-centers. Lesions of the cerebrum also may be attended by vertigo, apparently more especially when situated in regions which stand in relation with the cerebellum, such as the frontal lobes. It may have its origin in a disturbance of vision; or, again, in some disturbance of digestion; also in disturbances of other visceral functions, *e. g.*, the renal. Again, it may be the expression of a disease of the heart or of a general disease of the vascular apparatus, such as an arteriosclerosis. It appears also that vertiginous attacks sometimes take the place of epileptic seizures; it is very difficult, of course, to differentiate between such seizures and attacks of petit mal. It is not impossible, however, that an attack of epilepsy should be preceded by or, in the case of petit mal, accompanied by a vertiginous attack. Persons suffering from migraine may also suffer from vertigo. It is probable further that vasomotor disturbances—vasomotor ataxia—may be responsible for attacks of vertigo. Finally, it may be present by itself as an independent symptom; *i. e.*, without being in any discoverable relation with disturbances in any organs or functions; in such case it is termed essential vertigo.

That vertigo may be excited artificially is known to every child who tries the experiment of turning rapidly around a number of times in succession. The vertiginous sensations of sea-sickness have doubtless an origin in a similar disturbance of the sense of space relations. Again, vertigo, as is well known, may be excited by the passage of a galvanic current through the ears, and this so-called galvanic vertigo is remarkable for the fact that the person experimented upon tends to fall toward the anode on the closure of the current and toward the cathode on the opening of the current.

If a case of vertigo presents itself, the important matter, before treatment can be considered, is the differential diagnosis. The first step is to differentiate between a subjective and objective vertigo. If the vertigo be subjective or attended by almost no objective disturbances, we are to think of general disturbances, such as are met with in neurasthenia and in toxic states. The fatigue symptom group of neurasthenia is so well known that the affection is very readily recognized, and a brief inquiry will determine whether the patient is subjecting himself to any of the ordinary forms of intoxication. The examination of the urine will readily disclose a disease of the kidneys or of some diathetic affection. An examination of the heart and blood-vessels will enable the physician to judge as to the existence of cardiovascular degenerations. The attention of the physician may be directed by the patient at the very beginning to disturbances of the ears, eyes, or stomach; but even when this is not the case, these organs should always be carefully studied.

The affections of the ear which may be attended by vertigo are most varied. The disturbance may have its origin in the external, the middle, or the internal ear. Usually, more or less decided auditory symptoms are present. Commonly, it is accompanied by some impairment of hearing—frequently a marked impairment. Generally, this impairment of hearing is accompanied by a diminution in the bone conduction in one or both sides, and with especial frequency do we find tinnitus aurium. Usually, an attack of auditory vertigo is ushered in or preceded by an attack of tinnitus or, if tinnitus be continuous, this becomes for the time being more pronounced. Tinnitus is, however, not by any means always present, nor is impairment of hearing necessarily present. Occasionally, nystagmus is observed and at times double vision makes its appearance. In a case studied by Oppenheim nystagmus made its appearance when the eyes were turned toward the side of the affected ear. Other observers have occasionally noted nystagmus when the eyes were directed toward the sound ear. Auditory vertigo may occur daily or at intervals of weeks or months. Again it may occur with excessive frequency. At times it is continuous or almost continuous; rarely, it is so pronounced that the patient is afraid or actually unable to leave his bed.

Auditory vertigo is commonly, though incorrectly, spoken of as Ménière's disease. However, it is not by any means necessary, as it was at one time thought, that there should be disease of the labyrinth; labyrinthine vertigo may be indistinguishable from that due to other affections of the ear. Thus, the same symptom complex may make its appearance as a result of disease of the middle ear or as a result of disease of the external auditory meatus. Notwithstanding, we should bear in mind that the symptoms in the majority of cases point to an involvement of the labyrinth, and, especially in the absence of disease of the meatus or middle ear, involvement of the labyrinth should always be considered. In the form of vertigo described by Ménière the cause appears to have been hemorrhage into the labyrinth. Diseases of the blood-vessels and trauma appear to be adequate causes. Again, disease of the labyrinth may ensue upon disease of the middle ear. It is noteworthy, however, that vertigo is but rarely an accompaniment of an acute otitis media. It is probable that the deafness of Ménière's disease is due to involvement of the cochlea and the vertigo to involvement of the semicircular canals. Ménière's disease, at least with an apoplectiform onset, is in the writer's experience very rare. Frankl-Hochwart was able to find but twenty-seven cases of Ménière's disease in the literature. However, in such case the vertigo is described as very severe; the patient may fall to the ground, and there are present severe nausea, vomiting, deafness, and tinnitus. Curiously enough, the loss of hearing is usually bilateral, and while the loss of hearing may not be total, it is, as a rule, very pronounced. Gradually, the nausea and vomiting subside, and as the days pass by the vertigo lessens and may altogether disappear. Impairment of hearing, however, remains, as a rule, more or less pronounced. The diagnosis of Ménière's disease is to be based upon the suddenness of the attack, the deafness, the tinnitus, the intense character of the vertigo, and upon the exclusion of other possible causes of the vertigo.

In many cases of chronic heart disease vertigo is met with as a symptom. It must, of course, be differentiated from attacks of transient faintness or cardiac weakness. However, it appears to have its origin in this very cardiac weakness, and is apparently due to a momentary failure of the blood-supply to the brain. It is not infrequently met with in myocarditis.

Ocular vertigo is very rare. Gowers looks upon it as due to an erroneous projection of the visual field, and believes that the impression received influences the centers of equilibrium. At times, also, it has doubtless to do with the double vision present in some cases. The sensation is seldom intense. It is not important save from the standpoint of diagnosis. Disease of the nasal mucous membrane or of the sinuses appears in rare cases to be associated with vertigo.

Gastric vertigo is so closely associated with the taking of food, and often with the symptoms of indigestion, that the diagnosis is, as a rule, made very readily. This is also true of the vertigo associated with constipation.

An affection, in which vertigo is a very prominent symptom, was described many years ago by Gerlier as occurring endemically in the Canton of Geneva, Switzerland; there were present, besides very pronounced vertigo, ptosis, marked weakness of the extremities, weakness of the muscles of mastication, and at times diplopia and other visual phenomena. The affection is not one which it seems to the writer should be considered under the head of vertigo. It appears to have been very obscure and due to some general cause—possibly infectious or toxic in character—in which vertigo was merely a prominent symptom. Gerlier gave it the name of *vertige paralysant.*

The treatment of vertigo is, of course, the treatment of the affection of which it is a symptom. It is not necessary to review in this connection the treatment of the neurasthenic and various toxic states with which it is associated, or of the various conditions of the auditory, visual, digestive, or vascular apparatus of which it may be an accompaniment.

In the forms of vertigo in which no special cause can be discovered and those forms of vertigo which seem to be due to disease of the cardiac, renal, and vesical apparatus, general principles must be applied. In this connection the iodids, upon the one hand, the cardiac tonics, upon the other, and the stimulation of the excretion of the skin, kidneys, and bowels is the obvious line of treatment to be employed.

An attack of Ménière's disease should, of course, be treated by active purgation, sweating, counterirritation back of the ear, absolute rest in bed, together with the bromids or other sedatives, and later by the iodids. If other forms of aural disease are present, they should, of course, receive appropriate treatment, which cannot be discussed here.

The efficiency of the bromids, reënforced now and then by belladonna, should be borne in mind. The free administration of quinin has been thought to do good; there is, however, the justifiable fear that quinin may make worse the deafness already present. Babinski has practised lumbar puncture with apparent success. Electricity has also been employed, but with no decisive result. The seton has been employed with asserted benefit. In desperate and continuous vertigo the attempt may be made to secure relief by extirpation of the semicircular canals. This appears to have been followed by success in cases operated on by Lake and Milligan.

EPILEPSY

Epilepsy is an affection characterized by irregularly recurring attacks in which loss of consciousness is the dominant feature. In its mildest expression the attack consists of a brief suspension or absence of consciousness. In its more pronounced form the loss of consciousness is attended by a convulsion. For our present purposes it will be necessary to consider briefly, first, the generalized form of epilepsy,—that is, the essential form,—and, secondly, the epilepsy of the focal form, in which the symptoms point to definitely localizable lesions; the latter is commonly spoken of as Jacksonian epilepsy.

The generalized form or essential epilepsy presents itself in the form of petit mal; that is, of attacks characterized by brief periods of suspension or absence of consciousness; in the form of grand mal; that is, attacks in which convulsions are present; and, thirdly, in the form of seizures in which so-called epileptic equivalents substitute the attacks of petit mal or grand mal. As already intimated, the attack may consist merely of a brief suspension of consciousness or it may be ushered in by an aura—a signal symptom. Most commonly, no history of an aura can be elicited. When present, however, the aura may be of most varied origin. Most frequently it is sensory, and consists of a tingling or numbness beginning in an extremity. At other times it is motor, and is ushered in by muscular twitchings; these likewise usually begin in an extremity. At other times the aura has its origin in one of the special senses; thus, the patient may hear sounds of various kinds, ringing of bells, voices; he may see colors, lights, curious shapes; he may have disturbances of taste or smell. Sometimes the patient makes gustatory or tasting movements of the tongue and lips. Sometimes an attack is ushered in by a sudden vasomotor change, such as sudden pallor of the features, or by a sudden emotion or sensation of fear. Following upon the aura more or less closely comes the convulsion. This begins with a tonic spasm, often ushered in by a shrill cry. This tonic spasm, as a rule, lasts a few seconds only, being soon replaced by clonic convulsive movements. The movements are at first small in extent, but are very forceful, involving the trunk, the muscles of the neck and head, and the extremities. The latter are, as a rule, involved symmetrically. They rapidly increase both in extent and in violence. The duration of the active convulsion varies from a few seconds to several minutes. Gradually, the violence of the convulsion moderates, the patient becomes quiet, consciousness gradually returns; the patient seems somewhat heavy and stupid, may complain of headache, may vomit, and usually falls asleep. It is not infrequently noted that the tongue is bitten during the convulsion, while the urine and even the bowels may be voided. The patient is always unconscious during a true epileptic seizure, the unconsciousness, as a rule, dating from the time of the onset of the convulsion. He can sometimes remember and give an account of an aura, but he cannot give an account of the convulsion. Not infrequently the epileptic seizure is substituted by an epileptic delirium which is of great intensity and is sometimes attended by violent assaults on the part of the patient. The duration of an epileptic delirium varies from several hours to several days. Rarely delirium passes into an active confusion and may then persist for several weeks. Post-epileptic mental disturbances may arise after the seizure or may be a continuation of epileptic delirium. The picture presented is that of confusion, of delirium, or of stupor.

Although space will not permit us to enter into a detailed discussion of the pathology of epilepsy, the following facts should be borne in mind. Especially important is it to note that a large number, if not indeed the majority, of epileptics present morphologic peculiarities indicative of arrest or deviation of development. These peculiarities are similar to those met with in the great group of defectives, notably imbeciles and idiots, though they are by no means as marked or as striking. However, a narrow or irregular palate, abnormalities of dentition, anomalies of the external ear, peculiarities of skull conformation, of the features, of the limbs and digits are constantly noted. It is a justifiable inference that if the surface markings indicate arrests and deviations of development, the deeper structures must present a similar evidence, and that the organism as a whole is defective and aberrant in development. In keeping with this fact the writer found, many years ago, that the brains of epileptics presented anomalies in the development of the convolutions and fissures and that these anomalies were often gross and striking. Lastly, in keeping with this fact of arrest and deviation is the fact that epilepsy is very common among idiots and imbeciles; and finally and especially, that epilepsy makes its appearance early in life—in childhood, puberty or youth, and that it is progressively more and more infrequent after adult life has been attained; *i. e.*, after twenty-five or thirty.

Purely pathologic studies of epilepsy are disappointing. In the first place, no constant findings are revealed by autopsy. The sclerosis of the cornu ammonis, noted long ago by Meynert, and the changes in the brain, noted by Bevan Lewis, Buchholz, Chaslin, and others, of a disproportionate increase of glia, cannot be regarded as of themselves sufficient to explain the convulsions; and space will not permit of a discussion of the relations of the motor area to essential epilepsy save to point out that this area is in all probability the seat of the disturbance which manifests itself in the explosion; at least, this interpretation is justified by all the facts at our command. Quite in conformity with modern medical thought is the theory which regards epilepsy as due to an autointoxication. A large number of writers have of late years adopted this view, though proof of such autointoxication is still very meager. However, several significant facts are known; thus the urine possesses a greater coefficient of toxicity immediately after an epileptic attack than before. In the intervals of the attacks the urine is distinctly hypotoxic. The inference would seem to be justified that retained toxins were active in the production of the epileptic seizure. Collolian found that the serum of the blood, especially at the time of the seizure and directly afterward, was toxic in character, in contrast to the blood of healthy persons. Again, epilepsy has been attributed to gastro-intestinal intoxication, for example, by Marchant. While the theory of autointoxication in epilepsy cannot be considered established, its probability should be taken into consideration when we undertake the problem of treatment.

Treatment.—Before considering the administration of medicine it is necessary to bring up the general health to as high a level as possible. To this end we must institute a thoroughly hygienic method of living. It is a well-known fact that if this be done, the frequency of the attacks is much diminished. It is of the utmost importance, first, that the patient should live as much as possible in the open air, and that he should sleep in a well-ventilated room. It is very probable that the increased oxidation of the tissues which results favorably influences the autointoxication from which the patient appears to suffer. The patient should, of course, exercise, but this exercise should not be strenuous. Gentle exercise, such as walking, gardening, light farm work, is indicated. If the exercise be hard or excessive, the frequency of the seizures will increase; the toxicity of the patient seems to be unfavorably influenced by the fatigue substances thrown into the circulation under such circumstances; fatigue—overfatigue especially—is always bad. The same is true of nervous overstrain or emotional disturbances.

Secondly, it is of the utmost importance to keep the various emunctories of the body active. The action of the skin should be promoted by sponge-bathing or by brief immersion-bathing, followed by gentle rubbing. The bowels should be kept freely open, and if this cannot be accomplished by the diet, some simple saline, such as the phosphate of soda or some simple laxative water, should be given. It is the writer's custom to bring about, if possible, two bowel movements daily. In addition, the patient should drink freely of water between meals so as to promote the action of the kidneys.

The diet of epileptics, while not, as a rule, demanding rigid modification, is of some importance. A mixed diet is indicated, and yet epileptics do best if the diet is slightly modified. Thus the amount of carbohydrates should be moderate in amount. Starches and sugars not only favor the digestive disturbances and catarrhal conditions so often noted in epileptics, but they also make increased demands upon the functions of oxidation and, indirectly, elimination. They should not, however, be rigidly excluded. The same is true of the red meats; the latter should not be given too freely. The white meats, milk, eggs, and the succulent vegetables can be given liberally. Tea, coffee, alcohol, and tobacco had best be excluded. It is unnecessary to add that salt meats, fried foods, and like indigestibles should be forbidden.

The epileptic further requires abundant rest. He should retire relatively early. Everything which will bring about undue physical fatigue or nervous or mental overstrain should, as a matter of course, be avoided. Surroundings free from worry or undue excitement are also best, for obvious reasons. In many cases the colony farm method of treatment offers many advantages because of the possibility of inducing simple hygienic living under competent supervision.

In a large number of patients it is necessary to give medicines to control the seizures, but in cases in which the attacks are very infrequent, *i. e.*, occurring but once in a number of months or but a few times in the year, it is wisest to omit medication and to rely solely upon general methods. Under ordinary circumstances, however, the seizures are so frequent that it is necessary to give medicines for their control. The most valuable are the bromids. While very many other remedies have been introduced from time to time, the bromids are the only ones which hold their own. We should give them, the writer believes, in such doses in the beginning as to make a profound impression both upon the frequency and the intensity of the seizures. Full doses, as a rule, need not be long continued, and it becomes possible, little by little, to diminish the amount until the dose is found which is sufficient to maintain a reasonable control over the attacks. The various salts of bromid are about equal in their therapeutic value; the potassium salt, however, if long continued, may prove more depressing than bromid of sodium or bromid of ammonium. Bromid of strontium has not, in the experience of the writer, shown itself to be especially efficacious. Quite commonly several of the bromid salts are given together, though the plan does not seem to have especial value. Sometimes Fowler's solution is added to the prescription because of the acne which usually follows free bromid administration. It is a good plan, while the bromids are being administered, to reduce to a minimum the amount of table-salt which the patient consumes. The food should be prepared without any salt whatever being added, and the bromid should be administered immediately after the meal. It is very probable that the bromid in a measure replaces the sodium chlorid under these circumstances. At any rate, no disadvantage can result from following such a plan as this, and patients soon become accustomed to getting along without the salt. It is not necessary, however, to withdraw the salt absolutely. Attention was first directed to the possible substitution of the bromid salts for sodium chlorid by Richet and Toulouse, who proposed a rigid plan of withdrawal of the table-salt and its full substitution by the bromids, claiming that the latter under such circumstances proved more efficient even in smaller amount. However, the consensus of experience has not justified such radical withdrawal and substitution. Indeed, certain disadvantages may follow, such as loss of appetite, disgust for food, and even digestive disturbances.

In very severe cases it may be wise to institute the treatment originally proposed by Flechsig in 1893, namely, of increasing the efficiency of the bromids by a previous course of opium. The plan consists in giving the opium, preferably a liquid preparation, in moderate doses, three times daily, and slowly and steadily increasing the amount as tolerance is established. The opium is administered for a period of some six weeks, after which it is abruptly withdrawn and bromid given in large doses, say from forty to sixty grains three times daily. The opium inhibits the seizures during the time of its administration, while the action of the bromids subsequently administered is greatly increased.

Antipyrin added to a dose of bromid is also efficacious in diminishing the frequency of the attacks in severe cases. Five grains and upward may be given with each dose of the bromid. The antipyrin should, of course, after a brief period be withdrawn. Many other remedies have been used in the treatment of epilepsy. Among these may be mentioned antifebrin, borax, chloral, cannabis indica, hydrobromic acid, the iodids and mercurials, monobromate of camphor. None of them, however, can be claimed to have established a reputation for genuine efficiency, that is, an efficacy comparable to the bromids. Silver nitrate has in former years been employed in severe cases, even to the point of producing argyria, but with a questionable result. It is at present rarely employed. Occasionally, in cases in which the seizures occur with great frequency, a few drops of tincture of belladonna or minute doses of atropin are added to each dose of the bromid; the writer, however, has failed to note an especial advantage from this expedient. It is perfectly justifiable, in cases of great severity, to add for a time small doses—five grains or ten grains—of chloral hydrate to each dose of the bromid. Tincture of digitalis is added by Gowers, while adonis vernalis has been used by others. Doubtless the stimulation of the heart's action is of advantage in some cases. Solanum, or horse-nettle, has now and then been found beneficial, especially in the epilepsy of children, in which it seems to diminish somewhat the frequency of the attacks. It should be given in doses of fifteen drops of the fluidextract and gradually increased. Conclusive evidence as to its value is, however, wanting.

In a small percentage of epileptics there are present, with or without stigmata of arrested development, some of the symptoms of hypothyroidism; *e. g.*, myxedematoid infiltration of the skin, sometimes slight, sometimes more pronounced. In such cases very marked benefit is derived from the administration of small doses of thyroid extract.

The treatment of the epileptic seizure itself requires a brief consideration. If there is a well-established peripheral aura, originating in an extremity, the attack may at times be averted by suddenly grasping the extremity, or the patient can wear a strap or other ligature about the extremity, say the arm, which can be suddenly pulled taut when the aura first makes its appearance. In this way the aura is sometimes arrested and the attack inhibited. In some instances simply striking the extremity, for example, the hand, a sudden blow against a table or neighboring object may arrest the aura. Patients in whom an aura is so arrested sometimes complain of a feeling of discomfort and of vague distress. Others manifest irritability, headache, and dizziness, symptoms which are apt to disappear if a seizure finally makes its appearance. The inhalation of a few drops of nitrite of amyl may successfully avert a seizure. Sometimes other procedures which make a decided impression upon the special senses, such as quickly placing salt or a piece of ice upon the tongue, will now and then inhibit a seizure. If a seizure has made its appearance, it becomes necessary to see that the patient is so placed that he cannot injure himself. The clothing should be loosened, especially about the neck, while a cork or some other object, about which a handkerchief has been wrapped, should be quickly thrust between the teeth to prevent the biting of the tongue. When the attack subsides, the patient should be allowed to rest; he usually sleeps. If he be awakened, he will commonly complain of headache and of general discomfort. If the epileptic seizures succeed each other with great frequency, so that a status epilepticus ensues, it is a good plan to give full doses—forty to sixty grains—of chloral hydrate by the bowel. Other sedatives may, of course, be employed, such as scopolamin or hyoscin hydrobromate hypodermatically. This may also be given with the addition of morphin, though the latter is rarely indicated and is of itself of little value. If the status epilepticus be very severe and does not yield to simple measures, it is wise to make a trial of chloroform inhalation.

It is of the utmost importance in every case to make an exhaustive physical examination. Gastric and intestinal disturbances, if present, should be corrected. The presence of nasal polypi should receive attention. Diseased teeth should be removed or treated. Intestinal worms should be expelled. The eyes should be looked into. The genitalia should be examined, especially in boys. Finally, a careful search should be made for scars or other evidences of traumata, especially about the head.

If the facts of the case, such as a late beginning, throw doubt upon the essential character of an epilepsy, the possibility of alcoholic, lead, or other form of poisoning should be investigated.

An epilepsy may be distinctly focal in type; that is, the attacks may begin in a definite manner in one and the same extremity and may subsequently spread to other portions of the body and become general;

or the convulsion may be limited to one extremity and may in such case not be attended by loss of consciousness, a form termed Jacksonian epilepsy. Again, epilepsy may owe its origin to trauma; *e. g.*, injuries to the scalp, bone, dura, or brain.

The treatment of epilepsy due to gross organic disease, such as tumor, or of epilepsy the sequel of trauma, at once raises the question of surgical interference. Each case must, of course, be decided for itself. Essential epilepsy does not, for obvious reasons, justify operative interference. However, cases not infrequently arise when the diagnosis between an essential epilepsy and one of focal origin becomes exceedingly difficult. Focal epilepsy makes its appearance not infrequently without the added symptoms of gross brain lesion, such as optic neuritis, headache, and vomiting; and yet, if the attacks be clearly focal in character, either in onset or throughout the attack, an exploratory operation is not only justifiable in so grave a disease as epilepsy, but clearly indicated. If tumor or other grave disease be discovered, the problem becomes one of surgery. If no gross lesion be found, the question of excision of the center should be considered and should be decided by the definiteness of the symptoms and the gravity of the case. Excision of a leg center would, for obvious reasons, not be justified, but whether the resulting palsy of an arm—and which is usually incomplete and may undergo considerable improvement—is not preferable to confirmed epilepsy, may be seriously questioned. However, it should be borne in mind that the excision of the center may not arrest the seizures, especially in cases in which they have been long established. In the absence of focal symptoms, operative interference must be limited to the excision of depressed or thickened bone, spicules of bone, scar tissue, and like surgical conditions.

INFANTILE CONVULSIONS

In infancy there is a greater liability to convulsive seizures than in older children. This may possibly be due, on the one hand, to a more highly irritable condition of the nerve-centers and, on the other, to an imperfect inhibition, the latter itself being related to the as yet imperfect development of the various nervous tracts.

Infantile convulsions may be separated clinically into those which occur immediately or shortly after birth and those which occur after the lapse of several months or within the first two or three years. Thus the newborn may suffer from convulsions due to traumata of the brain arising from dystocia; *e. g.*, prolonged compression of the head or conditions involving delay and instrumental interference. The most common lesion is meningeal hemorrhage. The convulsions may be slight and brief, or more frequently are severe and often prolonged. Sometimes distinct localizing symptoms are present; at others, the convulsion is general and local weakness or palsy is absent. In such cases surgical interference should always be considered, and if the indications are at all clear, the interference should be immediate. How much can be accomplished under such circumstances has been shown by Cushing, and how urgent it is is shown by the disastrous results of meningeal hemorrhage in such children as survive. Cerebral diplegia, hemiplegia, epilepsy, and general mental arrest are the common sequels. The treatment, of course, consists in the early or immediate opening of the skull and evacuation of the clot. The condition present, *e. g.*, the membranous character of the bones, renders the procedure relatively easy. The details, however, will find their proper expression in a surgical treatise.

Infantile convulsions other than those related to childbirth are quite rare in the first few weeks or months of life. They coincide largely with the period of dentition, and are related, in the majority of cases, —at least two-thirds,—to digestive disturbances. Quite frequently the cause is evidently a simple attack of indigestion, of overfeeding, or of the giving of food unsuited to the age of the child. In such cases the convulsion may make its appearance during any period of the digestive disturbances; usually, however, several hours elapse after the latter has begun. Instead of a simple attack of indigestion there may be the signs of a gastro-enteritis and intestinal infection; however, convulsions are less frequent in chronic gastro-intestinal disturbances than in the acute. Further, convulsions are less frequent and less pronounced the older the children. Convulsions due to digestive disturbances appear to be most frequent in the months of June and July, while in August and September they are relatively rare.

Digestive disturbances produce convulsions at times through peripheral irritation, at other times through autointoxication, or through both of these causes combined. Among causes other than digestive disturbances the various infectious diseases are to be considered. Thus convulsions may make their appearance in the course of the various eruptive fevers, especially in the period of invasion, in the course of throat affections, tonsillitis, pneumonia, poliomyelitis, whooping-cough. They may also make their appearance as a result of difficult dentition, or of other peripheral irritation and possible infections, such as otitis media. It should be borne in mind also that uremia may also give rise to convulsions in children, just as in adults.

The attacks bear a general resemblance to epileptic seizures. Frequently, however, distinct prodromata can be noted. For example, if the child be sleeping, the mother may note that it is restless, that it is frequently disturbed by sudden movements, by gritting of the teeth, or by sudden convulsive shocks in the extremities which may awaken the child. The face, too, may present a peculiar expression, the lids being slightly open so as to render the whites of the eyes visible. If the child be awake, it may be irritable and crying. It is restless and may throw itself about, more especially on its back. Distinct shocks soon make their appearance in the extremities and the convulsion follows. Sometimes the eyes are turned upward, deviated to one side, or may twitch violently to and fro; or a strabismus, fugitive or intermittent in character, may be noted. The pupils vary somewhat, though they are usually contracted, the more so the more violent the seizure. Usually the attack is in the beginning distinctly tonic, but soon, as in epilepsy, it becomes clonic; the tonic phase, however, may be lacking, the convulsion beginning with clonic movements.

Contrary to what we note in the epileptic attack, the urine and bowels are usually not evacuated, though this may occur. The child is, as a rule, quite unconscious, and if the convulsion be somewhat prolonged, it may become somewhat cyanotic, due to the interference with the respiration. It may cry out as the attack comes on or as the attack subsides. As a rule, it does not emit any cry during the attack. The pulse-rate is usually decidedly increased, and now and then a rise of temperature is noted, though most frequently this does not occur. Rise of temperature would, of course, suggest a gastro-intestinal or other infection. Death may ensue during a convulsion and may be the result of the exhaustion and of the action of the toxin or infection that may be present. An elevation of temperature, more or less marked, usually precedes death.

Finally, the fact also that infantile convulsions occur more frequently in rachitic children than in others should be borne in mind, and also that children of a neuropathic makeup or heredity are more liable to convulsive seizures than others.

Treatment.—The treatment of infantile convulsions must be in part directed to the cause, if this be discovered, and in part symptomatic. If the attack owes its origin to indigestion, attention should, of course, be directed to the intestinal tract. Vomiting should be encouraged, free evacuation and lavage of the bowel, the administration of small doses of calomel, and like expedients are indicated. If the trouble be due to difficult dentition, the gums should be freely lanced. If the febrile affections, such as the various exanthemata and other infectious diseases, are in course of development, appropriate treatment should, of course, be instituted. Measures for the control of the convulsions are, however, imminent no matter what the cause. As a rule, they call for the administration of the bromids or of chloral, or of both these drugs combined. A small dose of antipyrin added to a dose of bromid sometimes proves very efficacious. If the stomach be intolerant, the chloral can be given by the bowel, often with success. If the convulsions are persistent, cautious use may be made of chloroform inhalation. At the same time the child should be immersed in a lukewarm bath, that is, a bath of the temperature of 90° to 95° F. Care should be taken not to make use of a hot bath. The child may remain in the bath for fifteen or twenty minutes, or for a longer period should the convulsions persist. Cold compresses may at the same time be applied to the head, according to the case. Later, if necessary, mustard plasters may be applied to the back of the neck or to the extremities. Lumbar puncture has been practised in severe cases, but it is a doubtful expedient.

PUERPERAL CONVULSIONS

Convulsive seizures may make their appearance during the last stages of pregnancy, during childbirth, or in the puerperal period.

They are met with more frequently in young primiparæ. As is well known, they may be renal in origin, and a distinct disease of the kidney may be confirmed by autopsy findings. However, it not infrequently happens that the amount of albumin in the urine is small or entirely wanting; so, too, the microscopic examination of the urine may prove entirely negative. On the other hand, we should remember also that not infrequently women who already have Bright's disease may pass successfully through pregnancy and childbirth.

Of course, explanations of infectious and toxic origins have been evoked to explain the occurrence of puerperal convulsions, but no specific infectious cause has as yet been discovered; none, it might be added, which seems probable. It is not, of course, impossible that there may be a special condition of toxicity due to the absorption of toxic products from the placenta, and that in cases where there is renal insufficiency this toxicity may induce convulsions. It is not impossible, further, that in pregnancy there may be an undue irritability of the nerve-centers and a more ready response to toxic irritants. If distinct signs of renal insufficiency be present, they always constitute a cause for anxiety. Distinct prodromata are either not present or they are ill defined and consist of restlessness, headache, dizziness, and vague discomfort. The attacks may very much resemble those of epilepsy. They may be extremely violent, very prolonged and persistent, and may in their general character resemble status epilepticus. In severe cases a rise of temperature, more or less pronounced, usually occurs.

Treatment.—The indications are very clear. Labor must be induced or, if already present, hastened and expedited. The methods to be employed are, of course, to be decided by obstetricians. Whether simple dilatation or some more radical surgical procedure is to be practised must depend upon the urgency and circumstances surrounding a case. I believe that surgeons are inclined to resort to the less radical procedure of dilatation in most cases.

Secondly, everything must be done to allay the irritability of the nerve-centers and to favor elimination. The bowels should be freely evacuated, liquids should be administered in liberal amount to stimulate the action of the skin and kidneys. Hypodermoclysis is especially indicated. Sweating should be promoted, and in given cases venesection should be practised. At the same time the bromids and chloral should be administered in full doses. If the convulsions be very severe and persistent and time will not allow for the absorption of the bromids and chloral, small doses of morphin sulphate, grain $\frac{1}{16}$, and scopolamin, grain $\frac{1}{200}$, may be tried hypodermatically and repeated if necessary. Chloroform inhalation may also be cautiously practised.

Care must, of course, be taken to maintain the strength of the patient, and if necessary the fluidextract of digitalis or, better still, digitalone may be given hypodermatically to sustain the heart. Nitroglycerin and oxygen inhalation may also be employed, but are less valuable expedients. Whether lumbar puncture has any value remains to be determined. Its indications are not very clear, and opinions are divided as to its efficacy.

CHOREA

Chorea presents itself in the form more especially of the chorea of childhood,—the so-called chorea minor or Sydenham's chorea,—the hereditary chorea of Huntington, and so-called electric chorea.

It is a notable fact that chorea occurs with frequency among children, more especially in children from six to twelve or thirteen years of age; it appears also to be more common in girls than boys in the proportion of about three to one. It is an affection which is characterized by irregularly recurring movements of one or more extremities, of the face, or of some other portion of the head or neck. These movements, to some extent, simulate voluntary movements; they do not consist of sudden or spasmodic twitchings, but are somewhat slower; they are irregular and of varying extent and character. The movements may begin in the hand, the arm, or face, usually upon one side, and then spread gradually to the other. As a rule, the movements are most marked in the extremities, but the muscles of the tongue, of deglutition, the eye muscles and even the muscles of respiration, may become involved. Sometimes the movements are most pronounced upon one side of the body or may be limited to one side, in which case the affection is termed a hemichorea. Quite commonly also the muscles of the child are somewhat weak, and at times this weakness becomes a prominent feature of the case. The electric reactions of the nerves and muscles remain normal. The reflexes are usually unchanged, and there is no involvement of the sphincters. Rarely, when the attack is very severe, a rise of temperature has been noted.

Mental changes have also been observed. These are frequently noted early in the case. The children are, as a rule, irritable, easily frightened, somewhat petulant, emotional, or apathetic. In exceptional and very severe cases even mental confusion may come on, and more rarely delirium. The history which is so frequently obtained in the case of Sydenham's chorea, of a prodromal period of pains in the joints, has led to a collocation of chorea with acute articular rheumatism. The not infrequent occurrence of endocarditis in chorea is in keeping with this relationship. In a large number of cases a history of actual swelling of the joints cannot be elicited; however, a history of pains referred to the joints or to the limbs generally can very frequently be obtained. Sometimes the description of the pain is vague; often the term "growing pains" is used by the mother. Whether we accept the prevalent interpretation that the pains are due to ordinary rheumatism or whether we regard them as due to a separate and specific infection, the evidence points none the less conclusively to an infectious process. That the infection is less serious than that concerned in ordinary rheumatism would be evidenced by the absence of gross or persistent changes in the joints, and by the relatively mild and usually negligible character of the cardiac complications. Further, the vast majority of cases terminate in spontaneous recovery, though now and then in rare instances a fatal case is met with. Usually the number of fatal cases is given as 2 to 4 per cent., but this the writer would regard as much too high. In an extensive hospital experience, covering many years, he has observed but one fatal case.

The duration of an attack of chorea varies from six to ten or twelve weeks. The prolonged cases are usually met with among the older patients. In the latter also endocarditis, when present, is apt to be much more pronounced.

It must be especially borne in mind that chorea is very prone to recur. At least one-fourth of the cases suffer from two, three, and often more attacks. The season of the year most favorable to the development of chorea is the spring, and in the out-patient departments we often see the same patients returning with the season.

Chorea rarely appears as a sequel of scarlet fever, measles, or typhoid fever; under such circumstances it offers a much less favorable prognosis. Finally, ordinary Sydenham's chorea may not be limited to childhood, but may make its appearance as late as puberty, after puberty, or even in adult life. It becomes, however, less and less frequent in proportion to the age, and while almost no period of life is absolutely free from it, it is exceedingly rare in adult life. Doubt may be legitimately entertained whether late cases are really Sydenham's chorea. This doubt applies especially to senile chorea and also the chorea of pregnancy. In the latter affection at least special causes appear to be at work. The chorea of pregnancy occurs more frequently in young women, in primiparæ, and in the early months of pregnancy. In very rare instances it persists throughout pregnancy; rarely it makes its appearance late in pregnancy or even in the puerperal state. It would seem, all things considered, that chorea is a symptom, and that it is not always due to one and the same toxin.

The chorea of pregnancy also presents a very different prognosis from ordinary chorea, for it presents a mortality of 25 per cent.; death results from exhaustion, from the inability to take and to digest food, and from insufficient sleep and rest.

Treatment.—The treatment of chorea should be based upon general principles. Everything should be done to raise the health of the child to as high a level as possible. The withdrawal from school, and if practicable the institution of partial rest methods, should be insisted upon. Milk should be freely added to the diet and various tonics administered. If the case be at all severe, the patient should be put to bed and a full rest treatment carried out. This is, as a rule, followed by the most gratifying results. For the details of such a treatment the reader is referred to the section on Neurasthenia.

If the movements are very severe, so that the patient does not sleep or that he is liable to injure himself by striking his limbs against the bed, the edges, head- and footboard of the latter should be carefully padded. It is wise also under such circumstances to administer some sedative, such as chloral, in moderate doses. Better, however, than chloral is trional, which in small doses is exceedingly well borne by children and has the most gratifying effect in quieting the movements. Two grains of trional given to a child six, seven, or eight years of age, at intervals of two to four hours, will sooner or later produce a decided impression; subsequently the drug can be diminished or withdrawn. The bromids may also be used, though they are, in the experience of the writer, less efficacious than trional. Among older children small doses of the fluidextract of cimicifuga, five or ten drops, may be occasionally employed, but is rarely indicated.

Among the tonics to be administered, the one most commonly relied upon is arsenic in the form of Fowler's solution. This remedy, while exceedingly useful, must be administered with caution. According to the age of the patient, we should begin with two or three drops, gradually increasing the dose one drop daily until six, seven, or even more drops are administered three times a day. The arsenic is, as a rule, well borne, but it is important to watch for signs of intoxication; the occurrence of puffiness below the eyes, gastric irritation, or diarrhea should at once lead to the withdrawal of the drug. While arsenic is well borne by the majority of patients, children are occasionally met with in whom this is not the case, for now and then so serious an accident as neuritis has been observed to follow the administration of arsenic for chorea. Chorea is an affection which is especially frequent among the children of the poor, and who are often under the care of out-patient departments of hospitals; and it now and then occurs that a mother, through ignorance, gives too large doses or keeps on with the administration of the drug for a longer period than is necessary or fails to return with the child to the hospital at proper intervals.

Because of the relation of chorea to rheumatism, sodium salicylate has been tried in chorea, but with a doubtful degree of success. Moderate doses of antipyrin have also been used. Iron makes a convenient and valuable substitute for arsenic at times. Other tonics may, of course, also be employed.

HUNTINGTON'S CHOREA

Huntington's chorea is a form of chorea which is hereditary. It occurs most frequently between the ages of thirty-five and forty years; it rarely begins after forty-five years of age and it is rare before thirty. There is almost invariably a history of the disease in the preceding generation. Huntington, in his original paper, stated that his father and grandfather, who had practised medicine in the eastern end of Long Island for many years, had known certain families in which this form of chorea has existed for generations. It occurs in equal proportion in the two sexes. As a rule, if one member of a family escapes, his descendants also escape. The movements begin gradually, usually in the upper extremities, and are at first slight. Later on they become more general and more pronounced. Not only the extremities, but the trunk, the muscles of the neck, face, and head, become involved. The patient also experiences difficulty in speaking and even at times in swallowing. The movements are more extensive than those seen in ordinary chorea, and the patient often shifts from one dramatic pose to another. The gait is interrupted, consisting of a series of strides and haltings. Occasionally a hop or two are interspersed. Of course, the gait varies greatly in different cases. At first the patient seems to have some control over the movements, but later on all control disappears. Indeed, if he makes an effort to quiet his movements, they, as a rule, become more pronounced. The strength of the muscles does not seem to be greatly influenced. Sensation also remains uninvolved. The reflexes are, as a rule, increased. Contrary to what is found in Sydenham's chorea, the heart presents no anomalies. Quite commonly mental symptoms are noted and actual mental disease is not infrequent. The patient is depressed, sometimes persecutory, and at others suicidal. As a rule, he wishes to be left alone; he does not like to talk, probably because his distress is increased while under observation and by the effort to speak. Because of the mental symptoms, Huntington's chorea is not infrequently spoken of as dementia choreica. Huntington's chorea is essentially an incurable disease. As the years pass by, patients become weaker and finally become confined to bed. It is, however, an affection of very slow course—a duration of from ten to thirty years is not uncommon.

We possess no definite knowledge with regard to the pathology of Huntington's chorea, and its discussion in no way aids our helplessness in regard to treatment. Suffice it to say that various changes, such as disseminated or miliary foci of encephalitis, diffuse meningo-encephalitis with atrophic changes in the cortex, proliferation of the neuroglia, infiltration of the cortex with glia cells, and atrophic changes in the central convolutions and elsewhere have been described by various writers. Everything points to a degenerative affection beyond our control.

Treatment.—The treatment is merely that of simple hygienic care. Rest methods and other physiologic procedures, so useful in other functional nervous diseases, here fail utterly. Gentle occupation and diversion should be carried out as long as possible.

ELECTRIC CHOREA

The term "electric chorea" has been applied to cases in which the movements occur with great suddenness. It appears that a number of different affections have been embraced under this name, and the legitimate doubt further arises at to whether the term "chorea" is not improperly applied to them. Again, it is not improbable that many cases of so-called electric chorea really belong to the category of hysteria. Others again bear an undoubted relation to myoclonus and paramyoclonus multiplex, themselves affections doubtless often hysterical in character. In the form of electric chorea described by Hirsch, sudden, lightning-like spasms occur in the muscles of the shoulders and neck. In the form described by Dubini as occurring in northern Italy, the patients at first complain of pain in the neck and back; soon lightning-like contractions make their appearance in one-half of the body; *i. e.*, the arm and the face and leg upon the same side; subsequently the spasms spread to the opposite side of the body. Sometimes the case is complicated by epileptiform attacks. Pain and fever are present. Palsies may also make their appearance, and not infrequently in the limbs first involved. The palsies may become widely diffused and be attended by wasting and changing in the electric reactions.

The prognosis is unfavorable—but few cases recover. Death supervenes upon the increasing exhaustion; heart failure and coma terminate the picture. It would appear that we have to deal here with some specific and as yet unknown infection. In the form of electric chorea described by Bergeron we have an affection in which sudden spasms make their appearance in children of from seven to fourteen years of age, usually of delicate and anemic appearance. The spasms affect the muscles of the back of the neck, the shoulders, and arms. The movements are not infrequently restricted to one extremity; on the other hand, a large part of the body may be involved. The affection strongly suggests hysteria, and is probably merely a manifestation of this neurosis. The prognosis is uniformly favorable, the cases yielding to simple physiologic methods and tonics.

TIC

In the consideration of psychasthenia, among other symptoms, defects of inhibition were pointed out which express themselves in various movements. The latter frequently become pronounced, and, following the French, are spoken of as tic or as tic convulsif. The movement is, as a rule, one in which various muscles or groups of muscles are concerned, and its character suggests some voluntary act or automatic gesture.

Tic occurs most frequently about the face. Very frequently it consists of winking or of winking associated with other movements. At other times the movements occur about the mouth and lips. Grimaces, sniffling, sudden protrusion of the tongue, or other bizarre movements may make their appearance. The movements may involve variously the muscles of the neck and shoulders, and the patient may suddenly and repeatedly bow, shrug his shoulders, nod, turn, or throw back his head, his action resembling voluntary gestures. The arms too may move, the hand being carried to the head, the face, the beard; or the movement may consist of rubbing of the hands or of one arm by the opposite hand or of an arm against the trunk. Similarly, though to a less extent, may the lower extremities be involved. The patient may suddenly rise from his chair, take a step or two, and turn or perform some other curious movement. The impression made upon the observer is for the moment that of a movement made voluntarily and by design. Quite commonly the patient during the movement emits sounds or exclamations; sometimes phrases or fragments of phrases are emitted, the latter interlarding or interjecting in a senseless way the speech of the patient; sometimes the words uttered are profane, foul, obscene, in which case the symptom is spoken of as coprolalia.

The movements of tic occur at irregular intervals. Usually the same movements or series of movements recur. They come on spontaneously or are provoked by effort, by excitement, by the examination of the physician.

The important practical points to recognize in regard to tic are the following: first, the affection is not an ordinary spasm, but the movement is essentially psychic in its origin; the action is that of a voluntary gesture frequently expressive of an attitude of mind, an emotion, an intention; at others of an action difficult to understand or interpret, but none the less clearly psychic in its character. In other words, tic is a psychoneurosis, and, as I have elsewhere pointed out, is properly classifiable under psychasthenia. For the treatment of this condition the reader is referred to p. 896.

HABIT SPASM

Closely allied, if not identical with, tic convulsif, is a condition described as habit chorea by S. Weir Mitchell, and as habit spasm by Gowers. It is manifested by slight spasmodic movements of small groups of muscles, which result in winking or twitching of the mouth or other transient and slight grimaces. The movements have a semi-voluntary aspect. It occurs frequently in childhood, between about six and fourteen years of age, and is apt to subside as the child grows older. Occasionally the movements become extensive, involving the trunk and limbs, and then constitute true tic; in such case they are, of course, likely to persist. In rare cases slight movements persist through youth and even throughout adult life. However, the general rule obtains that cases in which the less pronounced condition of facial twitching alone is present are likely to subside and in this respect the milder affection differs from tic proper, which is essentially a persisting affection.

When a habit spasm makes its appearance in a child, everything should be done at once to raise the level of health according to the method already indicated in the treatment of neurasthenia and hysteria. The eyes, of course, should be carefully examined, disease of the conjunctiva, if present, should be treated, and if necessary the eyes corrected. Similar attention should, of course, be given to the nose, the pharynx, the mouth and teeth. An extensive consideration of the treatment is here unnecessary. Full feeding, proper hygiene, and the administration of tonics are all important.

LOCALIZED MYOSPASMS

Myospasms involving a muscle or group of muscles, either clonic or tonic, may occur and may affect the muscles of almost any portion of the body. More frequently, however, special muscle groups or those representing special nerve distribution are involved.

Facial Spasm.—Clonic facial spasm or painless tic, the form most commonly met with, consists of an irregularly recurring contraction of the muscles supplied by the facial nerve. The contraction may be diffused over all the facial muscles or may be limited to certain groups. In the diffuse form the symptoms are limited to one-half of the face, though it occasionally happens that certain movements, such as winking, are bilateral. As a rule, the spasm does not affect all the muscles simultaneously, but begins in one group and spreads to the others. There is not, however, any regularity in the order of sequence. Thus the mouth may be suddenly drawn up, the alæ of the nose may twitch, the eyes may blink, and then the whole side of the face may become involved. The entire paroxysm usually lasts for a fraction of a second or for a few seconds only. At other times, though rarely, it lasts for a minute or even longer. In rare cases the spasm consists of a single muscular contraction, or more frequently it is made up of a number of clonic movements which quickly increase in rapidity until a maximum is reached, when they again become slower and gradually die away. Sometimes, however, both the onset and the cessation of the spasm are abrupt. Following the spasm there ensues an interval, relatively long in duration, in which the face is quiet or almost quiet. The length of this interval varies greatly in different cases. Sometimes it lasts many minutes and in mild cases the spasm may occur only occasionally in the course of the day. In other cases the paroxysms occur with great frequency, indeed, so much so at times as almost to simulate a tonic spasm. In other cases again, in which a decided interval is present between the spasms, minute local and isolated twitchings may occur during the interval. As a rule, the contraction of the zygomatic muscles and the elevators of the angles of the mouth and nose predominate over the contractions of the other muscles. Next in frequency the spasm affects the orbicularis palpebrarum, and least frequently the depressor of the angle of the mouth. Some of the muscles of the facial nerve-supply are very rarely involved; this is especially true of the occipitofrontalis and of the platysma; it is also rare in the muscles of the palate and still more so in the muscles of the ear. However, no muscle of the facial supply is exempt. Again, occasionally, though rarely, the spasm is not limited to the facial supply alone, but radiates into other nerve territories. Thus in rare cases the spasm may involve the masseters and temporals, or it may spread to the muscles of the neck and even to those of the arms and shoulders. It is to be especially noted that no weakness or paresis can be detected in the affected muscles, nor are the electric reactions, as far as they can be studied, changed. Sometimes facial spasm is bilateral. Thus the zygomatics of both sides may be involved and at short intervals a grin or smile passes over the patient's face. At other times it is the corrugators that are affected and the patient frowns without cause. Again, it is the orbiculares palpebrarum that suffer. The involvement of these muscles may be so slight as to cause but a barely perceptible twitching of one or both eyelids. At other times the spasm of the orbiculares may be so pronounced that the contraction may last for several seconds or even many minutes. Indeed, the blepharospasm may be so severe as to be practically continuous, and may occur so frequently as to make the patient to all intents and purposes blind. During the spasm the lids may be so firmly closed that by no effort of will can the patient open them. Curiously enough, blepharospasm can now and then be relieved when pressure is made with the finger upon certain points. Thus if firm pressure is made upon the supra-orbital notch or upon the course of the supra-orbital nerve higher up, the spasm not infrequently ceases. Now and then these curious pressure-points are found upon the infra-orbital branch, and sometimes indeed upon areas that bear no relation to the fifth nerve whatever. Thus they have been found on the back of the neck, on the shoulder, in the axilla, and on the arm as low down as the wrist. Pressure-points, it should be added, may be met with not only in blepharospasm, but also in generalized facial spasm. Whether hysteria does not play a rôle in some of these curious cases is, of course, a point to be considered.

Treatment.—In all cases the mouth, teeth, the eyes, and the nose should be carefully examined. The fifth nerve should be thoroughly explored throughout its various divisions, and this result proving negative, the entire body should be examined, especially in children; the intestinal tract must not be forgotten.

Quite frequently nothing whatever is found to which the attack can be attributed and we are forced to treat the affection symptomatically. Among the measures that have been adopted are counterirritation by blistering or burning over a small area high up over the cervical spine or back of the ear. Freezing of the face with a volatile spray may be tried. Unfortunately, neither the counterirritation nor the freezing gives very decided results. Electricity in the form of the constant galvanic current yields results so discouraging as to make it scarcely worth the trial. Surgical treatment has been resorted to with more or less benefit, though, as a rule, for limited periods of time only. Thus the facial nerve has been stretched, but just as soon as the ensuing paralysis disappears, the spasm reasserts itself. During the interval, however, the patient is relieved for many weeks or even for many months. Section of the facial nerve yields a similar result and the relief is apt to be of longer duration, but when reunion takes place, the spasm recurs. Deep alcoholic and osmic acid injections may also be tried. These not infrequently give decided results, and are usually more persistent than those obtained by stretching, while the resulting weakness of the nerve is not so serious, of course, as that resulting from section. Various drugs have been employed internally without decided benefit. In very severe cases of blepharospasm and, indeed, all other forms of facial spasm, there is but one drug which has a decided effect, and this is morphin. When used internally, or, better still, when injected hypodermatically near the exit of the nerve, it markedly lessens the spasm. However, morphin is rarely a justifiable drug to use in such cases. Deep alcohol injections are much to be preferred.

That the general hygiene of the patient should receive care, as in other functional nervous disorders, goes, of course, without saying. The reader is again referred to the methods employed under the general head of neurasthenia and hysteria, for not infrequently the patient presents, along with the facial spasm, the signs of a more or less pronounced deterioration of nervous health.

Tonic Facial Spasm.—In a given number of cases we meet with tonic spasm or contraction of the face. This tonic facial spasm is most frequently met with as an after-result of Bell's palsy, the muscles having been paralyzed a long time, secondary contracture supervening, just as it does in the arms and legs in hemiplegia. Very rarely tonic facial spasm is said to follow exposure to cold and also to be an accompaniment of hysteria. This the writer himself has not observed. The treatment of tonic facial spasm or contracture is, as a rule, ineffectual, though sometimes vigorous facial massage with stretching of the contracted muscles is beneficial. The constant galvanic current may also be employed.

SPASMODIC TORTICOLLIS

Spasmodic torticollis, or spinal accessory spasm, as it is also termed, consists of a spasm of certain muscles by which the head and neck are rotated to one side or from side to side. At first sight the affection suggests spasm of the muscles supplied by the spinal accessory nerve, that is, the sternocleidomastoid and the trapezius. However, while these muscles are affected, one or both, in all or probably all of the cases it is well known that the spasm is not confined to these muscles, but involves a great many others; *e. g.*, the splenius, the scaleni, and the numerous deep rotators of the skull and cervical spine. Owing to the relatively large size of the sternomastoid and the trapezius, the movement is largely influenced by their action; sometimes one or the other predominates. That rotatory spasm may occur independently of these muscles is proved by cases in which the spinal accessory nerve has been in part resected and the trapezius and sternomastoid paralyzed.

The movements which occur in spasmodic torticollis are characteristic. Every minute or every few seconds the head is forcibly drawn to one side, the mastoid region depressed, the chin elevated and turned toward the opposite shoulder. Many modifications of this movement may be observed, depending upon the special muscles involved and the degree of their involvement. It should be borne in mind that the affection is in reality one of the *movement of rotation* and not one of individual muscles. However, the action of the sternomastoid is, as a rule, quite evident; it usually stands out prominently during the spasm and becomes very hard to the touch. At times it undergoes marked hypertrophy. Similar though less marked changes may be noted in the trapezius.

The spasm varies somewhat in character in different cases. Sometimes it consists of a series of short, jerky movements. At other times it is a long-drawn and continuous movement in which the head and chin are moved through an area of relatively wide extent. In pronounced cases the torsion of the head and neck is so pronounced as to attain a maximum. The spasm in rare cases persists for many minutes at a time, so that the head is held more or less fixedly in one position. Curiously enough, in the large majority of cases it is the muscles of the right side that are involved. Quite commonly the intervals between the attacks of spasm are relatively long and usually constitute periods of complete or almost complete rest. At other times, however, they are so short that the contractions appear to be almost continuous. The spasm usually ceases during sleep. Rarely, however, sleep is seriously interfered with.

As a rule, the spasm is not accompanied by any pain. However, a dull, aching sensation is sometimes referred to the affected muscles; as a rule, to the upper part of the trapezius and sternomastoid, and, quite frequently, to their points of origin on the occiput and mastoid process. The pain is very much like that of a fatigue ache. Now and then the patient complains of pain which he refers to the back of the neck and the cervical spine and sometimes to the dorsal spine, and slight sensitiveness to pressure may be met with in these regions. Curiously enough, in rare cases pain is referred by the patient to the upper part of the right arm. Once in a while points of tenderness may be found over the spinal accessory nerve. Occasionally such a point, when pressed upon, arrests the spasm. At other times pressure-points, not painful in character, such as are met with in facial spasm, are met with in torticollis. They are rare, and when they exist are usually over the spinal accessory nerve. Very rarely the movement may spread to the facial muscles, the platysma, the muscles of mastication, and even to the muscles of the arms. This is, however, very frequent.

Treatment.—The treatment of spinal accessory spasm is both medical and surgical. Drugs, as might be inferred, yield no definite result. Among them may be mentioned the bromids, belladonna, hyoscyamus and cannabis indica; in the experience of the writer they are not worthy of trial. Morphin, as in the case of facial spasm, gives decided relief. The spasm always diminishes and sometimes ceases entirely while the drug is being administered. The morphin habit is, however, the inevitable outcome, and for this reason it should never be used except in extreme cases and for short periods of time only—for instance, in cases in which the spasm is so severe as to make sleep impossible.

We are, fortunately, in possession of another drug, gelsemium, which, while it does not give the degree of relief afforded by morphin, is invaluable, because in a large number of cases it decidedly mitigates the symptoms, and it accomplishes this result without the formation of any baneful habit. In large doses it is, of course, a poison and its use should be attended with great care. It may be given in the form of the fluidextract, beginning with one or two drops, at intervals of several hours. Four hours is a convenient interval, as the effect of a single dose lasts for from three to four hours. Very gradually, drop by drop, the dose may be increased until five, ten, or fifteen drops are reached. Twenty drops should constitute a maximum dose and should under no circumstances be exceeded. The patient is, of course, to be closely watched during its administration, and if ocular symptoms, such as double vision, make their appearance, it should be at once discontinued. However, it would appear that by beginning with small doses, a certain degree of tolerance is established. During the use of the drug the spasm diminishes to a very marked degree and in some cases it almost ceases. The amelioration is often so profound that it adds very materially to the comfort of the patient; further, the improvement usually continues for some time after the drug is discontinued.

It is an excellent plan to put a patient with spinal accessory spasm to bed for a time upon a course of full rest treatment. The affection occurs most frequently in women, and especially in women who are decidedly neurasthenic, and under these circumstances a course of rest treatment proves to be very beneficial; furthermore, if gelsemium be used during such a treatment, a maximum amount of benefit is attained. For the details to be pursued during the period of rest in bed, the reader is referred to p. 865.

Among local measures, electricity is practically useless. In severe cases surgical intervention should be considered. In a large number of cases the spinal accessory nerve has been cut, stretched, or resected. Great improvement follows such treatment, but, as a rule, the spasm recurs after a number of weeks or months have elapsed although with lessened severity.

In accordance with a suggestion of S. Weir Mitchell, W. W. Keen some years ago devised an operation for resecting the posterior divisions of the first three cervical nerves, in addition to resection of the spinal accessory. The result is, as a rule, one of marked improvement; a moderate amount of spasm may recur and persist, but in my cases the relief has been very great. Even more extensive operations have been practised, but in my experience the spasm is never entirely abolished, and this is due to the fact that the muscles which are engaged in the movement of rotating the head and neck are very numerous; in addition to the trapezius and sternomastoid, at least ten can be enumerated which take part in the rotation of the head and neck.

Bilateral Spasm of the Muscles of Rotation.—Now and then the spasm of the muscles of rotation is bilateral. It comes on almost exclusively in children, in whom it is the result of dental irritation. If the muscles of the two sides act simultaneously, there is a movement as of bowing of the head, which is repeated at relatively short intervals. If the muscles of the two sides act alternately, the head is constantly rolled from side to side. Pain does not accompany the affection, but it is very distressing to the mother, and occasionally a very brilliant and happy result is achieved by merely lancing the gums. If this measure fails, other peripheral irritation should be sought for, special attention being, of course, paid to the intestinal tract.

Tonic Spasm.—Now and then the spasm which affects the muscles of the neck is tonic in character, the head being firmly held in one position. As a rule, the neck is bent to one side while the occiput is drawn backward and depressed and the whole head somewhat rotated. The position, of course, varies as to whether the action of the trapezius or sternomastoid predominates. This affection may be the result of the irritation of deep structures, such as disease of the cervical spine or of the meninges. Of course, in such cases other concomitant or later developing symptoms will be present. Quite frequently, however, the cause cannot be determined. It should not be confused with rheumatism of the muscles producing ordinary wry-neck. The treatment must, of course, be based upon the cause when the latter can be discovered. When the latter is not evident, counterirritation over the cervical spine may be practised, together with the administration of sedatives. If the case fails to yield to treatment, surgical intervention may prove of benefit. Thus, tendons of muscles may be cut and the head secured in a normal position by means of a properly constructed apparatus. The treatment of such a case becomes essentially orthopedic. Extension of the cervical spine may be practised with advantage. Surgical intervention should not be too long delayed, as the head may become permanently fixed in an abnormal position.

Masticatory Spasm.—Among the rarer forms of myospasm is masticatory spasm. It is occasionally met with in hysteria. Very rarely it exists as an independent affection. Under such circumstances, it is due to some peripheral irritation, such as caries of the teeth, neuralgia, or some irritation of the sensory branches of the fifth. Very rarely, also, lesions in relatively distant parts, such as the extremities, are followed by this curious affection. Irritation of the intestinal tract should not be forgotten. If hysteria has been eliminated, the teeth and the body generally should be carefully explored. If a rheumatic cause be suspected, the salicylates should be administered. If no cause be discovered, electricity, moist heat, counterirritation back of the neck or back of the ears may be employed, and in children a vermifuge may be tried.

MYOCLONUS—PARAMYOCLONUS MULTIPLEX

Myoclonus or paramyoclonus is an affection originally described by Friedreich, in which sudden, lightning-like clonic spasms occur in the muscles of the trunk and extremities; the facial muscles are only infrequently involved. The muscles of the two halves of the body are about equally affected, though corresponding muscles are only exceptionally involved at the same time. Paroxysms last for several minutes. The clonus is rhythmic, though its rate varies considerably. No attacks occur during sleep. Voluntary movements may inhibit or lessen them. The tendon reflexes are usually increased. The muscular strength is normal, as are also the electric reactions. It is usually an affection of adult life.

A special form of myoclonus has been described by Unverricht, in which the affection occurs in families and bears distinct relations to epilepsy.

The important matter in all cases of myoclonus is to make the differential diagnosis from hysteria. Hysterical myoclonus offers, of course, a good prognosis. Myoclonus other than hysterical, *e. g.*, true Friedreich's paramyoclonus, offers little prospect of cure. In any event, however, the general physiologic methods already fully considered under Neurasthenia and Hysteria should be applied here and should be thoroughly exhausted.

SALTATORIC SPASM

In saltatoric spasm, an affection originally described by Bamberger, the patient passes through a series of springing, jumping, hopping, or dancing movements whenever he attempts to walk, the movements usually being just as soon as the feet are placed upon the ground. They are absent in bed. Hysterical stigmata are usually present, and the affection does not really constitute a distinct clinical entity, but is only one of the many motor manifestations of hysteria. The prognosis is good. The treatment is that of hysteria. (See p. 878.)

THE OCCUPATION NEUROSES

The characteristic symptom of the occupation neuroses is spasm induced by the performance of certain and frequently repeated movements or actions. This form of myospasm is most frequently met with in writer's cramp or scrivener's palsy; not infrequent also are telegrapher's palsy and hammer palsy, while various forms are occasionally met among musicians and among other persons in whom the habitual performance of certain movements finally leads to a disturbance of the innervation of the muscles. It is important and interesting to note that this disturbance exists only for the particular movement in question, the muscles being for all other movements completely under the control of the will. The direct cause of the disturbance is unquestionably overuse and overexertion; however, it is not infrequently noted that the patient is in general ill health; frequently he is obviously neurasthenic or in bad general health. At times, too, the affection is met with in persons who are severe sufferers from migraine or who bear other earmarks of a neuropathic makeup.

In writer's cramp, which may be taken as a type of these disorders, the patient first notices that the hand fatigues more readily in writing; little by little his control over his pen is lost; the pen tends to stop or stick to the paper, and finally there comes a time when it is arrested in its movements by fixation. It is the flexors of the thumb, forefinger, and middle finger that are mainly involved. Occasionally the spasm involves other muscles of the hand and even muscles of the forearm. At times also the patient complains of aching or pain in the hand, present during the cramp, often persisting for a time afterward. The spasm is usually slight in the beginning, but becomes more pronounced as the affection advances, until finally it may become so severe that the mere attempt to grasp the pen may induce it. Tremor also may be added to the symptoms.

As already stated, the hand and arm are entirely normal for all other movements, and it is exceedingly probable that the symptoms are directly due to an exhaustion of the cerebral coördinations concerned in writing. The treatment should, of course, consist primarily in an entire abstention from writing. Frequently this cannot be carried out, and often, especially in mild or beginning cases, the patient is unwilling or cannot abstain entirely from writing, and in such case it is imperative to advise the patient as to the manner in which the continuation of writing will prove least harmful. Among the useful facts at our command are the following. First, as recommended by Gowers, writing should be executed by free movements of the shoulder and arm and not by the small muscles of the hand. The position in which the hand rests firmly upon the paper is to be absolutely avoided. Again, instead of grasping the pen with the thumb, forefinger, and middle finger, the handle of the pen may be thrust through a cork, large and conveniently rounded, and the latter grasped by the palm, the base of the thumb, and fingers. It is found also that patients write often more readily with a thick lead-pencil or a quill than with a steel pen. In short, anything which changes the detail of the coördinations required is helpful.

It can also be inferred, from what has been said, that treatment should also be directed to the general health. Often the relations to neurasthenia and neuropathic conditions is so obvious that general rest and physiologic methods are obviously indicated, and for these the reader is especially referred to the section on Partial Rest-treatment. Local treatment of the hand and arm by electricity and massage is not very effectual, though it cannot be denied that they often greatly encourage the patient by suggestion. That the fatigue is cerebral and not local goes without saying. This was clearly illustrated by a case, for some time under the author's observation, of a young telegrapher who acquired a typical telegrapher's palsy of the right hand. Of his own accord he began using his left hand, but it also promptly broke down, and was soon in a condition as bad as its fellow. Exercises general in character and not too fatiguing may be permitted, but these had best be taken in conjunction with the other physiologic methods indicated under Partial Rest-treatment.

The detailed consideration of other occupation neuroses is unnecessary, as their treatment embraces the application of the general principles here indicated.

MYASTHENIA GRAVIS

Myasthenia gravis is an affection the characteristic feature of which is a paresis, functional in character, but which closely simulates an organic palsy. Thus it most frequently makes its appearance in the form of a palsy which closely simulates true bulbar palsy; that is, a true inferior polioencephalitis. Instead of steadily progressing, as do cases of organic bulbar palsy, cases of bulbar myasthenia gravis vary from time to time as to the intensity of the symptoms, and some cases even recover. Among the various symptoms present we may find difficulty of articulation, difficulty of swallowing, weakness of the muscles of mastication and also of the facial supply in both the upper and the lower divisions of the facial nerve. The eye muscles are not frequently involved. Ptosis may be noted. The paresis may also involve the muscles of the neck, the muscles of the trunk, and the muscles of the extremities; there may be weakness in the arms and legs and even difficulty of breathing. There is no muscular wasting and there is no reaction of degeneration. However, the muscles soon become exhausted to faradic stimulation, the muscular responses becoming rapidly feebler until they finally disappear—the myasthenic reaction. After a period of rest the muscles again respond. Patients suffering from this affection become fatigued with extreme readiness, and, as already stated, there is, on the other hand, a marked tendency to remission of symptoms. There is no anesthesia and no pain. Mental symptoms also are absent. Marked improvement may ensue during the remissions, and may last for months and even years. As a rule, the symptoms make their appearance gradually, several weeks or several months being required for their maximum development. It may be exceedingly difficult to differentiate a case of myasthenia gravis from a case of polioencephalitis or polioencephalomyelitis, especially in the first attack. It is only by noting the progress of the symptoms, the presence of remissions, the absence of fibrillary tremors, the absence of wasting and of electric changes (save those of ready exhaustibility) that the diagnosis can be made. Care must be taken to differentiate between this affection and hysteria. However, hysteria very rarely if ever simulates bulbar palsy. It is only when the trunk and limbs are affected to the exclusion of the muscles of the bulbar supply—itself very rare—that the question of hysteria can arise.

The anatomic findings in the nervous system are negative. However, Weigert some years ago noted a round-cell infiltration of the muscles, this infiltration apparently having its origin in disease of the thymus gland. Similar observations were made subsequently by Goldflam and Flatau, Hun, Buzzard, Bolt, Steinert, and others. Buzzard, whose investigations have been the most comprehensive, observed this round-cell infiltration not only in the muscles, but in other organs. He does not regard the disturbance in the muscle function as dependent upon this infiltration, nor indeed does he consider the relation of the infiltration to disease of the thymus as established. He regards the muscle symptoms as due to a form of intoxication.

Treatment.—During an attack of myasthenia gravis the patient should be put to bed and every possible precaution used to avoid muscular exhaustion. The latter, it should be remembered, may involve the muscles of respiration and indirectly lead to death.

As much food as possible should be administered, preferably milk and eggs. Sometimes there is great difficulty in swallowing, so that solid food can be taken only with effort, and indeed at times not without danger to life. In cases in which the difficulty of swallowing is extreme, nasal feeding should be tried.

Massage, so useful in other asthenic states, is here inapplicable; at least it seems to deepen the fatigue rather than to relieve it. Electricity, also, cannot be used, as it rapidly still further exhausts the muscles. Tonics, especially strychnin, are indicated. The latter should be given at first in small doses hypodermatically and, if well borne, should be carefully increased. A cautious use may also be made of thyroid extract, say two grains three times daily. Delille and Vincent believe they have obtained good results in one case from the use of pituitary and ovarian extract. Finally, if a persistent and overacting thymus is really the cause of the symptoms, the indication would, of course, be the removal of this gland. However, such radical procedure would be accompanied by grave danger, as these patients bear anesthetics and shock badly.

TETANY

Tetany is a disease characterized by intermittent tonic spasm affecting symmetrically the muscles of the extremities, particularly those of the hands and forearms, causing the hands to assume most frequently the position of the "writing" or "obstetric" hand. The disease, as a rule, is ushered in by vague pains, a general sense of uneasiness, and a feeling of weakness and stiffness in the muscles, generally most marked in the arms. The duration of the prodromal period is usually short—sometimes only a few hours. Then a tonic spasm of the muscles makes its appearance, beginning in the fingers and thence spreading up the forearms and arms. The muscles of the flexor group are most affected. The thumbs and fingers become flexed—the proximal phalanges flexed, the middle and distal phalanges extended—so that the position of the writing or obstetric hand is assumed. However, this position does not invariably obtain; in rare cases the hand may be clinched, or the fingers opened out and spread apart; very exceptionally the spasm may be limited to a single finger. Spasm having been established in the hand, the wrist next becomes flexed, the forearm flexed upon the arm, and the arm adducted at the shoulder.

Signs of rigidity having made their appearance in the upper extremities, this symptom may also be noted in the lower extremities. However, in many cases the spasm is limited to the hands and arms, and no symptom of involvement elsewhere may be noted; or the patient may merely complain of vague drawing pains in the legs. However, if the lower extremities are involved, the toes become flexed, the foot arched, and the legs extended upon the thighs.

In addition to the muscles of the extremities others may in rare cases be involved. Thus the spasm has been known to involve the muscles of the trunk and neck. Very rarely other muscles, such as the muscles of mastication, the muscles of expression, the orbicularis palpebrarum or muscles of the eyes, may be involved. Even the tongue may be involved, and the fact that patients occasionally complain of difficulty of swallowing would suggest involvement of the constrictors of the pharynx. The larynx also may be affected. Indeed, spasm of the larynx, in contrast to the other symptoms just enumerated, is a not infrequent and serious accompaniment of tetany. The involvement of the muscles is almost always symmetric, but cases in which the spasm is most marked upon or limited to one side have been reported, though they are very unusual.

The attack of spasm, as a rule, comes on very gradually. It may last for a few minutes or may persist for several hours, or in rare instances even days. As a rule, it lasts from a fraction of an hour to two or three hours. During its height the affected muscles become very firm and hard and are somewhat sensitive to pressure. The intervals between the attacks may be very variable. The spasm may recur on the same day, the next day, or after several days, and during the interval the patient feels comparatively well, save that he may complain of slight pain and stiffness in the muscles. The degree of spasm varies in different cases: the contraction may be so slight that the patient may be able to overcome it temporarily by his own voluntary efforts; at other times it may be so severe as to resist the efforts of the physician to extend the joints during his examination.

In addition to the attacks of spasm, several other exceedingly important signs are, as a rule, present. These consist especially of the Trousseau, the Chvostek, and the Erb symptoms. Trousseau's symptom consists in the fact that the spasm may be brought on if absent, or may be made more pronounced if present, by pressure upon or constriction of an affected extremity. Thus, if during a passive interval the arm be grasped in such a way that the finger-tips of the physician forcibly compress the nerves of the inner aspect of the arm, the characteristic cramp sooner or later makes its appearance. When present, this symptom is pathognomonic of tetany; unfortunately, for diagnostic purposes, it is absent in about one-fourth to one-third of the cases. When elicited during an interval or in an otherwise doubtful case, its presence is of determining value. Chvostek's symptom consists of an extraordinary susceptibility of the peripheral nerves to mechanical stimuli. Thus, if the facial nerve be struck a light blow with the finger or percussion hammer just in front of the ear and below the zygoma, we observe twitching of the angle of the mouth, or it may be of all the muscles of the facial distribution; most frequently the reaction consists in movements merely of the angle of the mouth. At times this symptom may be elicited in the nerves of the extremities. Unlike Trousseau's symptom, Chvostek's symptom is not pathognomonic of tetany; it is occasionally elicited when there are no other evidences of disease. Erb's symptom consists of a greatly exaggerated electric excitability of the nerves. Exceedingly weak currents—*e. g.*, 0.1 to 0.7 milliampere (Pineles)—induce cathodal closure contraction, CaClC; slightly stronger currents, cathodal closure tetanus, CaClTe; AnClC and AnOC follow readily. AnClTe, CaOC, and even CaOTe are observed.

Another symptom, that of Hoffmann, less important, depends upon an increased mechanical and electric excitability of sensory nerves; paresthesia and painful sensations are experienced in the distribution of the nerve examined. Spontaneous pains, however, are also present, variable in degree. They are referred by the patient to the muscles, especially those affected by the contractures. They may be exceedingly slight. Exceptionally only are they severe. Paresthesia, such as formication and slight numbness, is often complained of. Anesthesia is not present. The reflexes, in tetany, are usually normal; they may be plus and rarely are minus or even absent.

Edema and redness in the neighborhood of the joints have occasionally been noted, as have also herpes and urticaria. Rarely falling out of the hair and of the nails or transverse markings of the nails, accompany the disease. Muscular atrophy has been noted, though it is unusual. Excessive sweating may occur during a paroxysm. Duskiness and cyanosis of the extremities may be noted, as also puffiness of the face and swelling of the eyelids. Fluctuations of temperature are rare; however, both rise of and subnormal temperatures have been noted. Respiration is unaffected.

An attack of tetany usually lasts several weeks. Rarely it is manifested by only a few or even one paroxysm. On the other hand, there are cases which extend over several months, though these are characterized by remissions more or less prolonged, in which the symptoms are in abeyance.

The prognosis, on the whole, is favorable. A fatal outcome is rare save in cases associated with dilatation of the stomach. In the latter the disease, probably owing to this complication, quite frequently terminates fatally. If the tetany is the result of thyroid plus parathyroid extirpation, the outlook is also very serious.

It is exceedingly probable that tetany is the result of some infectious process. It is quite well established that the lower classes, *e. g.*, young workingmen and the children of working people, and those whose hygienic surroundings are bad, are most frequently attacked by the disease. While rare in this country, it is quite common in certain cities of Europe, *e. g.*, Vienna, and not infrequently occurs in an epidemic form. The curious fact that tetany results from extirpation of the parathyroid glands suggests an intimate relation between these glands and the disease. Possibly the toxin of the infection in ordinary tetany in some way affects the functions of these glands; indeed, from the studies of Erdheim and McCallum and of Escherich, it would appear that actual changes take place in these structures. Tetany is of such varied origin that it is exceedingly probable that it may be the indirect result of the action of various toxins, possibly also of the action of these toxins on the parathyroid bodies. Thus it occasionally follows infectious fevers, such as measles, scarlet fever, and influenza. At other times it is associated with gastro-intestinal disturbances, indigestion, diarrhea, dilatation of the stomach, worms in the intestine. Finally, pregnancy and lactation appear greatly to increase the susceptibility to the disease.

Treatment.—General measures are at once to be instituted. The patient is to be placed upon absolute rest in bed. He is to have a nourishing diet, consisting especially of milk. Soups, broths, and meats had best be excluded. Elimination is to be encouraged by gentle bathing, preferably warm sponge-bathing in bed. The bowels also are to be kept open. To control the muscular spasm, various remedies may be administered; *e. g.*, bromid, chloral, chloretone, small doses of belladonna, or minute doses of hyoscin or scopolamin, gr. $\frac{1}{200}$ or less. Antipyrin also may be tried. Phenacetin and aspirin are also worthy of mention, especially if there be much pain.

If the patient has a form of tetany dependent upon or associated with dilatation of the stomach, the chief effort should be directed against the disease of this organ. Thorough lavage, rectal feeding, and surgical intervention to relieve the stenosis of the pylorus are indicated. If the case be dependent upon a diarrhea, intestinal antisepsis is to be aimed at.

The administration of parathyroid substance has thus far been of no avail, the result in this respect being similar to that noted after thyroid extract.

PARALYSIS AGITANS

Paralysis agitans, or Parkinson's disease, is an affection characterized by tremor, usually passive in character, a tendency to fixation of posture, rigidity of muscles, and often by a peculiar propulsive gait. The disease usually makes its appearance in the latter half of life; less frequently it is noted in relatively young individuals. Men appear to suffer somewhat more frequently than women.

It may be preceded for a long time by pain suggesting rheumatism, by paresthetic pains or other depressing sensations, or, on the other hand, all prodromata may be absent. The patient may observe that the hand and fingers of one side are trembling; the tremor may at first be slight and may at times disappear altogether. However, after a time it becomes established. At the same time, the affected limb becomes somewhat rigid and its movements much slower than normal. Little by little it is noted that the foot and leg of the same side are the seat of tremor, or it may be that the tremor crosses to the opposite side of the body so that both arms are affected before tremor is noted, or noted in any degree, in the legs. The face is wooden or mask-like, owing to the fixation of the muscles of expression. The trunk is inclined forward; the tremor may involve the head, the jaw, the lips, the tongue. The patient stands or remains seated in a fixed position, the arms somewhat adducted, the forearms partially flexed, the hands and wrists moderately flexed or extended, while the fingers assume the position of the writing hand; the proximal phalanges are flexed, while the middle and distal phalanges are extended. At the same time the fingers are the seat of tremor, the motion of the thumb and fingers often suggesting that of pill-rolling. It is noted that the tremor is passive in character, that it is at once arrested by voluntary motion or by directing the patient's attention to it. Later on this peculiarity may be somewhat impaired, so that the tremor may to some extent persist during voluntary motion.

If the patient attempts to walk, he may exhibit the phenomenon of propulsion, *i. e.*, he begins by walking slowly and then faster and faster until he may even be forced to run and may fall unless assisted. Similarly, though less frequently, retropulsion and lateropulsion may be noted. As the disease progresses, rigidity and fixation become more pronounced. The patient remains for the most part seated in a chair and moves about with increasing difficulty.

Sensory losses are not observed. The tendon reflexes are usually normal, though now and then moderately exaggerated. The Babinski sign is absent. There are no psychic disturbances save in rare and advanced cases, when visual hallucinations, mild confusion, mild depression may make their appearance. The disease runs a very prolonged course, fifteen or twenty years being not unusual. Death supervenes from exhaustion or complications.

The pathology of paralysis agitans is still a closed chapter. Autopsies have revealed merely changes such as are common to senescence, *e. g.*, sclerosis of the vessels and associated changes in the nerve-centers. Changes doubtful in character have also been found by some observers in the muscles. Most frequently, however, the result of the pathologic examination is negative. The fact that the symptoms—the positions and rigidity especially of the hands and arms—call to mind the similar phenomena resulting from parathyroid extirpation, suggests, of course, the possibility of parathyroid involvement; up to the present nothing is definitely known. The facts of the disease are, however, best met by the theory of an intoxication, probably an autointoxication, and here the parathyroids, possibly through defective action, may play an indirect rôle.

Treatment.—This resolves itself into one of simple hygienic quiet living. It is important, however, to bear in mind that though paralysis agitans is, so to speak, a functional nervous disease, it is the one disease,—possibly the only one,—to which rest-treatment is never applicable. Cases of paralysis agitans are not only not benefited, but are sometimes made worse, by full rest methods. Rest favors the tendency to fixation and rigidity, a tendency which, as we have seen, becomes of itself more pronounced as the disease progresses. Instead of rest in bed, gentle but systematic exercises are indicated in paralysis agitans. From the very nature of the disease the patient usually tends to remain quiet. The exercise may be passive or active, and the movements should be modeled after those devised by Frenkel for the treatment of tabetics. The patient also derives much comfort from the exercise. It should, of course, be very gentle and in many patients must be limited to gentle walking. The patient is often less conscious of his affection when in motion; even purely passive motion, such, for instance, as riding in a railway train, frequently gives a sense of relief.

Massage, as a rule, is badly borne by patients with paralysis agitans. This is true likewise of electricity. Bathing is also best limited to relatively simple procedures. Simple hygienic measures in which partial rest methods, not too radical in character, form a part, are the best. Life in the country, in the open air, life devoid of strain or excitement, adequate nourishment, the addition of milk to the diet, and abundant sleep are also of value.

Medication is not especially indicated. However, various tonics may be employed. Special symptoms sometimes require attention. Nervousness may be allayed by the occasional use of bromid. Sometimes excellent results, as far as the comfort of the patient is concerned, are secured by the administration of small doses, $\frac{1}{200}$ grain of scopolamin or of hyoscin, two or three times daily. Other sedatives are rarely necessary.

The administration of parathyroid substance, of course, suggests itself. The writer has tried it in a number of cases in doses of $\frac{1}{20}$ to $\frac{1}{10}$ grain three times daily. In almost every instance the patient has claimed that he felt better and the muscular rigidity certainly appeared to be less. However, the effect seemed not to be durable, and but little impression is made by the persistent use of the remedy.

FUNCTIONAL TREMORS

Among functional tremors we must distinguish the tremors of neurasthenia, of hysteria, hereditary or family tremor, senile tremor, and, finally, a tremor classifiable under none of these heads, but which is observed from time to time in neuropathic individuals. The tremors of neurasthenia and of hysteria have already received adequate consideration, and their treatment is the treatment of the underlying states of which they are symptoms.

Hereditary tremor is a rather rare affection. Frequently, the family history is entirely free of neuropathic features. Occasionally only do we meet with a history of alcoholism, mental disease, or epilepsy. Both sexes are equally predisposed. It makes its appearance in youth; rarely is its onset delayed to the middle or later periods of life. It is rather a tremor of small extent and is variable in rapidity, its rate ranging from about three to nine in a second. It is an intention tremor in type; in some cases, however, it is present, though less marked, during rest; it is always more pronounced during voluntary motion or effort. Sometimes it can be inhibited by the will. It is commonly seen in the hands, much less frequently in the feet, and still less frequently in the face, tongue, or head. Sometimes it becomes a little more marked with advancing age; in other cases again it persists throughout life with little change; sometimes it is subject to remissions; infrequently it disappears. It is an affection of but little consequence; it seems to exert no deleterious influence upon the life of the patient, for it is rarely if ever sufficiently marked to interfere with his vocation. Finally, it is uninfluenced by treatment. Occasionally made worse by fatigue, it again grows better by rest.

Senile tremor affects mainly the head and arms; it is a tremor of small extent; it grows less or disappears during rest; it is made more pronounced by voluntary motion and effort; it disappears during sleep. Senile tremor is uninfluenced by treatment.

Simple idiopathic or neuropathic tremor is a not very frequent affection, and appears to be allied to the myokymias and tics. As in the latter affections, the patient is obviously neuropathic, either in makeup or heredity. It affects preferably the hands, less frequently the head, facial muscles, or tongue. It is a fine tremor, diminishes during rest, and is made worse by voluntary motion and excitement. Sometimes patients attribute the onset of the affection to fright or shock. Sometimes the tremor disappears altogether for a time; more frequently it is persistent. It rarely causes the patient marked annoyance and is uninfluenced by treatment.

SLEEP DISTURBANCES

Abnormalities of sleep manifest themselves most frequently as insomnia, somnolence, dreams, nightmare, night terrors; less frequently as somnambulism, sleep drunkenness, narcolepsy.

Insomnia is a very frequent concomitant of neurasthenia and hysteria, and for its consideration the reader is referred to pp. 858 and 873. Frequently insomnia is the accompaniment of various forms of insanity; not infrequently it is attendant upon disease of the viscera; at other times it is the outcome of diathetic and infectious diseases; finally, it may be toxic in origin. When it is purely symptomatic, its treatment is, of course, the treatment of the underlying disease.

However, a simple insomnia, unrelated to any other disease, appears to exist. Sometimes it is habitual and even hereditary. At other times and more frequently it depends upon unphysiologic living, *e. g.*, as regards hours and habits of work, absence of exercise, sedentary and irregular habits of life generally.

As toxic causes tea, coffee, tobacco, and alcohol all play an important rôle. Tea and coffee, when taken during the middle or late in the day or evening, induce very pronounced insomnia in many persons. A similar result frequently attends the use or the too free use of tobacco. Alcohol taken in the evening or before going to bed usually predisposes to sleep, but in many individuals this sleep is very short and unsatisfactory; the patient awakens in a few hours or in the early morning hours and is unable to fall asleep again.

Treatment.—Every effort should be made to discover the cause of the insomnia. To this end a thorough internal medical study should be made of the case. Not infrequently cardiovascular, renal, or other visceral disease is discovered. More frequently some diathetic disturbance, gout or rheumatism, proves to be the cause, and under such circumstances the insomnia often yields promptly to appropriate treatment. The treatment of insomnia due to neurasthenia or to hysteria is, of course, the treatment of the underlying disease. In cases in which no explanation of the condition is afforded by examination of the patient, in which visceral or diathetic disease is not present, and in which the characteristic features of neurasthenia or hysteria are equally absent, it is, notwithstanding, a good plan to institute partial rest methods. (See p. 865.) Their special benefit lies in the fact that they necessitate a strictly physiologic plan of living and enforce regularity of habits. Frequently it is wise to modify the partial rest plan by instructing the patient to rise early, take a light breakfast, and exercise moderately in the open air. A short period of rest by lying down without sleep may be permitted after the midday meal. Gentle exercise by walking may again be taken in the afternoon. No mental work should be permitted in the evening. A relatively early hour should be prescribed for retiring, and, before preparing for sleep, it is often of value to give massage; hot milk given immediately after the massage often aids the coming on of sleep. Bathing, especially moderately warm bathing just before going to bed, frequently induces sleep; at times the drip sheet may be employed with great advantage. (See p. 867.) In general the methods already described for the treatment of the insomnia of neurasthenia are applicable to other forms of insomnia. Drugs must often be resorted to; the special method of their employment has already been considered in the section on Neurasthenia. Suffice it here to say that while they should be used with caution they should, in the beginning, be used in sufficient dose really to produce sleep; after a satisfactory sleep has been secured for several nights in succession, the drug should be diminished or substituted by a placebo. Trional, sulphonal, and veronal are among the more useful drugs. The bromids, chloral, hyoscin, scopolamin, and paraldehyd are variously employed. Morphin or opium is rarely required. If it is necessary to employ drugs for some time, they should be changed at intervals; no one drug should be given for any length of time continuously. The importance also of an absolute withdrawal of all drugs after a not too prolonged interval must be borne in mind.

In insomnia in which there is a gouty element it is wise to give a salicylate, preferably in association with a moderate dose of bromid at intervals during the day; *e. g.*, ten or fifteen grains of sodium salicylate with twenty grains of sodium bromid after meals. Such a combination, associated with the simple physiologic methods already outlined, often has a most happy effect and renders a hypnotic at bedtime unnecessary. Sometimes, in simple insomnia, bromid given in this way without the salicylate is equally successful. At times it is wise to omit the dose after breakfast, giving it after the midday and evening meals and at bedtime. In hysteria and, indeed, in insomnia from other causes suggestion in the way of a placebo often acts powerfully. Time and again a patient, if the suggestion has been made properly or sufficiently forcibly, will promptly go to sleep on a five- or ten-grain capsule of starch or a small powder of boric acid or creta præparata. Drugs, it should be clearly pointed out, should as much as possible be avoided. Especially is this the case when the patient is not under immediate supervision, as is the case with office patients whose renewals of prescriptions are often beyond the physician's control and who are, therefore, in danger of contracting drug habits.

Somnolence is met with in a number of affections, *e. g.*, in hysteria, in senescence, in mental diseases such as paresis, organic brain disease such as syphilis, arteriosclerosis, and brain tumor; occasionally in dementia præcox, infrequently in neurasthenia. At times it exists without ascertainable cause. It is needless to say its treatment is the treatment of the underlying disease. In cases in which the somnolence is not associated with any known clinical condition, it may be the result of some toxemia. Occasionally caases are met with in which the sleep comes on suddenly, is very profound, and resembles narcolepsy. Such cases, in addition to general measures, should be given the benefit of a course of thyroid extract, preferably small doses at first and more decided doses later on. The administrations of tea or coffee have but little effect on this strange condition. The sudden loss of consciousness that may constitute the only evidence of an epilepsy is, of course, a very different condition from that here considered. It is seen every now and then in epilepsy accompanying tumor of the frontal lobe; the term "narcolepsy" had best be restricted to epileptiform sleep conditions.

Dreams rarely require attention. However, their character is often significant. It is a well-established fact that in neurasthenic and exhausted states generally they are apt to be painful and disagreeable—at times horrible and terrifying. Often distressing dreams are directly referable to the condition of the digestive tract, the bladder, or the rectum. At other times they are distinctly sexual in character; in such case they may be associated with an orgasm or with an incomplete or suppressed orgasm. No general rule can be laid down for the control of dreams. General principles alone apply. Neurasthenic states must be combated, correct physiologic living instituted, and, above all, the nature of the symptom should be carefully explained to the patient. Cases in which the dreams are associated with spontaneous or suppressed sexual manifestations are much benefited by the administration of hyoscin or scopolamin at bedtime.

In nightmare we have an exaggeration of the state met with in the ordinary distressing dream. The dream is frightful; there are sensations of great physical and mental distress, a sense of oppression, fright, inability to move. The patient usually awakens groaning. It occurs more frequently among young women. Often the latter are anemic or chlorotic or present other evidences of ill health. The causes to be sought for are similar to those producing other distressing dreams; that sexual factors play here a special rôle, as has been recently claimed by Freud and his disciples, is not confirmed by the experience of the writer.

Pavor nocturnus, or night terrors, is a sleep disturbance occurring in young children. Usually, shortly after going to sleep, the child starts up in bed screaming, is terrified, trembling and crying with fear. The attack, which in some respects resembles nightmare, differs from the latter in the fact that it subsides more slowly. The child usually persists in screaming for a time, and only gradually becomes conscious and begins to realize where it is and to recognize those about it. Again, general causes are to be sought for. Digestive disturbances, dentition, worms, and, beyond doubt also, excessive fatigue and undue excitement during the day are at fault. General principles again must be applied in the treatment. Night terrors, distressing as they are to the mother, are really not of much importance. The claim sometimes made that they are related to or are the forerunners of epilepsy is, in the experience of the writer, without foundation.

Sleep drunkenness is a condition infrequently met with, but which occurs in adults and appears to be a counterpart of the night terrors of the child. Like the child, the patient starts up in his sleep in a sudden delirious excitement and terror. It is really an active delirium of short duration. Its cause is vague and must be sought in digestive disturbances or other local or general condition.

Somnambulism is a sleep disturbance occurring most frequently in children and young persons, in which the patient, while asleep, leaves his bed, walks about, and performs various acts, sometimes quite complex, and of which he may have no recollection afterward. It would appear that somnambulism is a dream partly acted, *i. e.*, a dream with motor expression. In the greater number of cases somnambulism has no profound significance, and the writer does not share the view that the phenomena presented are hysterical or epileptic in nature. However, when the condition is marked and persists through adult life, it probably has a neuropathic basis. Sometimes the patient and the patient's relatives are clearly neurotic. Not infrequently somnambulism occurs in a number of members in the same family. During the attack the patient is quite asleep, is usually awakened with difficulty, and may resist and struggle. Occasionally he meets with a serious accident, such as a fall from a window.

Ordinary hygienic and physiologic methods should be advised in cases presenting somnambulism; also absence of strain or excitement during the day, light and readily digested food for supper, and occasionally, if the sleep-walking occur frequently, a sedative such as bromid. It may be wise also to have a relative sleep with the patient.

SEASICKNESS

Seasickness is an affection characterized by a group of vague, depressing, subjective, and physical symptoms which find their culmination in nausea and vomiting. Carsickness and the conditions sometimes induced by being in a swing or riding in a carrousel are allied states. Much has been written and many theories formulated as to the nature of seasickness, but without pausing to consider these, we may regard certain facts as established. First, the condition is a real one. While psychic factors are present in many cases, the mere fact that animals other than man, *e. g.*, horses, dogs, cattle, sheep, and even birds, are affected, proves that the condition must have a physical basis. Secondly, adults are much more liable to seasickness than children; very young children scarcely if ever suffer. Again, a kind of immunization occurs in persons who are on board ship a great deal. There are persons, however, who never become accustomed to the sea and are ill every time they cross the ocean. The susceptibility, too, of the same individual varies at different times. Many persons remain unaffected as long as there is a quiet sea, but succumb as soon as the weather becomes rough. In transatlantic travel it is a common experience that with the onset of a storm there is an immediate increase in the number of passengers ill.

The attack may supervene gradually or it may have a rapid onset; the former is more commonly observed under the conditions of modern ocean travel; the latter, when the patient is suddenly exposed to violent motions, as in a small boat or by the sudden coming on of a storm. When it supervenes gradually, the patient first becomes conscious of a vague and ill-defined distress. He becomes quiet, ceases to talk, loses interest in conversation, cannot force himself to read. Some cases curiously manifest an abnormal desire for food, but more frequently there is loss of appetite, which soon amounts to disgust for food. At times there is headache, which is frontal, less frequently over the temples, vertex, or occiput. At other times there is merely heaviness or a vague distress made worse by motion. Nausea also makes its appearance; this commonly, though not always, eventuates in vomiting. Quite frequently dizziness is present. The latter, however, is rarely so pronounced as to be objective; true vertigo is rarely, if ever, observed. As a rule, the nausea is persistent and the vomiting, if established, may be quite obstinate. The bowels may be constipated; sometimes they are freely moved or there may be a profuse diarrhea. That this condition is accompanied by the signs of marked physical and mental depression goes without saying. The hands and feet may be cold; the surface of the body may be moist and the pulse small, soft, and compressible. In mild cases the patient may be relieved by the first vomiting; in other cases improvement takes place after the first few days at sea have been passed; in others again the symptoms may persist until land is reached.

The condition is doubtless due to the unusual and unaccustomed motion experienced by the patient, and it is a profitless discussion to attempt the solution of the problem as to the special way in which the mechanism of equilibrium or the subjective sense of equilibrium is disturbed. It is probable that not only the impressions received through the semicircular canals, but that other afferent impulses as well,—such, for instance, as are received from the muscles, the bones and joints, the eyes, indeed, all the impressions, the sum total of which gives rise to our normal subconscious sense of security and equilibrium,—are disturbed. Other causes than these are, of course, also at work, though they are of subsidiary importance. Among these are psychic factors, such as the suggestion received by seeing others who are ill, or, in persons of neuropathic or hysterical makeup, merely talking of the possibility of seasickness supervening may suffice to determine the attack. The confined atmosphere of the stateroom, the ship odors, the odor of food, may act as contributing causes. Finally, it is well known that persons in good physical condition are less liable to attacks than those who are nervous and worn out or who, before going aboard, have committed excesses in eating or drinking, especially the latter.

Prevention and Treatment.—It is a good plan to select a stateroom which is outside and as nearly amidship as possible. It is wise also to avoid undue fatigue just before sailing, to secure a good night's sleep, and to take a wholesome, satisfying meal before going on board. As regards the details to follow when once on board, opinions differ. Some persons immediately retreat to their cabins, have their meals served in their berths, and endeavor to keep as quiet as possible. If seasickness supervenes, they remain in their cabins until the attack has subsided; sometimes they remain thus secluded for a few days or perhaps for the entire voyage. Very susceptible persons believe that this is the best plan for them. However, it would seem that for persons of only average susceptibility, it is wiser to remain on deck as much as possible. Indeed, the very slight exertion required in getting about seems in many persons rapidly to reëstablish the coördination—the sense of equilibrium—disturbed by the unaccustomed surroundings. Again, it is often found wise to have the food served on deck if moving about threatens to induce sickness. The advantage of remaining in the stimulating open air is very great, and the patient is also much freer from the unconscious autosuggestion of illness than when he remains in his cabin.

Inasmuch as the bowels usually become constipated on board ship, it is important to take a mild laxative, such as Hunyadi or some other saline. It is wise also to remain resting in the steamer chair for some time after each meal. Between meals it is a good plan to secure a little gentle exercise at intervals by walking about the deck.

Numerous special expedients, some of them very curious, have been devised to prevent seasickness, all of them without avail. Among these may be mentioned swinging staterooms, swinging berths, and specially constructed chairs. Under the impression that seasickness is due to a form of ocular vertigo, patients have been advised to lie in their steamer chairs with their eyes closed, to wear smoked glasses, or to fix their eyes, if possible, upon some distant object. Under the impression that the affection is due to a disturbance of the semicircular canals, it has been suggested to drop cocain solution into the ear. In the belief that it is due to a mechanical disturbance or perturbation of the stomach, persons have been advised to wear abdominal compresses and bandages; cold compresses to the stomach and ice-bags to the spine have also been used. Even special respiratory procedures, such as taking a deep breath at intervals and holding it as long as possible with a view to fixing the diaphragm, have been recommended. The mere multiplicity of these measures is a sufficient proof of their uselessness. Special diets also prove equally worthless. If nausea has been established, it is wise, of course, to restrict the patient to liquid diet in small amounts. Here individual judgment and individual peculiarities are the best guide; thin soups, broths, tea, less frequently coffee, are useful; salt wafers may be nibbled. If the attack is in its early stage, solid food is sometimes persisted in with advantage; a feeling of satiety and physical comfort replaces the nausea. The latter, we must not forget, is often prolonged by insufficient food. Various drinks may, of course, be tried, but in the writer's experience they are of doubtful utility—in quantity they always do harm. Among them may be mentioned champagne, the carbonated waters alone or fortified by brandy, seltzer and Rhine wine, ginger ale, the various cordials, crême de menthe, small quantities of ice water, or, best of all, small pieces of ice held in the mouth.

A great many drugs have been used and recommended both as prophylactics and as curative agents. Among them may be mentioned the bromids, chloral, morphin, cannabis indica, antipyrin, phenacetin, chloralamid, chlorodyne, paraldehyd, sulphonal, and trional. In reality they do little good. Phenacetin is sometimes useful, if the patient can retain it, in relieving the headache. Other remedies may perhaps be used if specially indicated.

Strychnin and atropin in minute doses seem at times to do good. These drugs have the advantage of being capable of hypodermatic administration. They are, of course, not indicated unless there is marked physical weakness and depression. The strychnin may be given in doses of $\frac{1}{40}$ grain every four hours. It may be combined with a small dose of atropin, say $\frac{1}{300}$ or $\frac{1}{150}$ grain. The atropin, of course, diminishes the sweating and also appears to lessen the epigastric depression and nausea.

All things considered, the simple physiologic methods previously outlined prove, in ordinary cases, to be sufficient to make the patient reasonably comfortable until the attack subsides, and, on the whole, drugs and special methods may in most cases be safely dispensed with.

VASOMOTOR AND TROPHIC DISEASES

By H. C. Moffitt, M.D.

As the name implies, this group of affections is characterized chiefly by vasomotor and trophic disturbances, although sensory and secretory phenomena are not infrequently associated. Our knowledge of vasomotor centers and paths is yet meager. From results of clinical observation and experiment a cortical center lies in the neighborhood of the motor area. Fibers from this run probably in close association with the sensory paths through the internal capsule, and may be interrupted in a station in the basal ganglia before reaching the chief center in the medulla. The classic experiments of Claude Bernard have frequently been confirmed, but the exact situation of the center is still undetermined; Ludwig and Dittmar localize it in an area 3 mm. above the calamus scriptorius and 4 mm. long, and maintain that each half of the body has its separate center.

From the medulla fibers run in the anterolateral tracts to cells in the posterior lateral part of the anterior horn, the lateral horn and the intermediate gray substance between the anterior and posterior horns. From this center the course is through the anterior roots and rami communicantes to the sympathetic. Some few fibers may reach the peripheral nerves directly without traversing the sympathetic, and vasodilator impulses may leave the cord with the posterior roots (Kohnstamm, Bayliss, Gärtner, Stricker, Kolliker).

Of late, knowledge of the sympathetic has been considerably broadened by investigations of Laignel and Lavastine, Onuf and Collins, Langley and Anderson, Lewaschew, and others, as well as by the results of operations on the sympathetic, chiefly by the French school of surgeons—Chipault, Jonnesco, Jaboulay. The sympathetic ganglia may be regarded as autonomous centers (Langley), and still other vasomotor centers are probably represented by groups of cells in the vessel-walls.

This superposition of vasomotor centers and the relative independent action of each center have most important physiologic and pathologic bearing. Disturbances may arise from affections of almost any part of the nervous system, but are most marked in those of the central gray matter of the cord, of the sympathetic, and of peripheral nerves. One center may replace another, and it is probable the subordinate centers—as in the sympathetic ganglia—may subserve reflex action; Edinger thinks that even the local vascular centers may serve as reflex stations. There are both vasoconstrictor and vasodilator fibers; the latter are best known in the chorda tympani, the sciatics, the nervi erigentes. Jonnesco has shown that the vasodilators react to slighter irritations than the constrictors. Constricting fibers go to veins as well as arteries, and Kahn and Steinach have lately confirmed the observations of Rouget and Mayer that the capillaries possess true contractile power by means of branching cells within their walls, which on stimulation may lead to complete obliteration of the lumen. Stimulation of the peripheral stump of the cervical sympathetic caused the same contraction as a local irritation; contraction lasted one to three seconds and subsequent dilatation for a longer period. Landois demonstrated that there is a constant medium tonicity of vasomotors. Lewaschew has shown that vasomotor influences are most marked in peripheral parts because there the muscular coat of the blood-vessels is proportionately greatest. Oppenheim points out that the extremities are also most exposed to the thermic irritations which particularly affect the vasomotor system.

There is abundant clinical and experimental evidence to show that the nervous system exercises great influence over the nutrition of the varied tissues, but its mode of action is not yet clear. Samuel wrote in 1860: "Der Grund der Ernährung liegt in den Zellen, das Mass in dem vom Nervensystem ausgehenden trophischen Einflusse." He divided trophic changes into atrophy, hypertrophy, dystrophy, and thought there were separate trophic centers and nerves. Some opinions refer the trophic phenomena purely to vasomotor influences; other views favor specific trophic nerves in the sympathetic. From operations on the Gasserian ganglion, it has been shown conclusively that sensory loss alone does not necessarily lead to trophic disturbance (Kraus, Cushing). The influence of disordered rather than diminished innervation, first suggested by Charcot and Mitchell, has been emphasized by clinical observations of the last years. Weir Mitchell thinks irritation of sensory nerves may be transmitted centrifugally, and may affect the periphery. Marinesco and Goldscheider have shown the influence of sensory irritations from the periphery and of impulses from the cortical centers in preservation of the full integrity of the spinal trophic center of the muscles. Raymond and Hoffa have demonstrated that reflex muscle atrophy in joint affections may be inhibited if the posterior roots be divided, and sensory irritations be prevented from acting on the anterior horn cells. Nothnagel laid stress on the regulation of nutrition by the vasomotor nerves, and Oppenheim called attention to the effect on these of sensory stimuli.

Lewaschew showed that irritation of the sciatic may lead to changes in arteries and veins of the extremity. Lapinsky got vascular changes following section of vasomotor nerves, and showed similar changes as result of neuritis. Oppenheim would demand more than mere anesthesia and vasomotor influences to explain the trophic phenomena. He writes: "Ich nehme in teilweiser Anlehnung an Charcot, Vulpian, W. Mitchell an dass die Funktion der Spinalganglion eine pathologische Anstimmung, eine krankhafte Steigerung erfahren kann: dass diese nur dann normal funktionieren, wenn sie die ihnen von der Peripherie zufliessenden Erregungen ungestört nach dem Zentrum fortleiten können. Erkrankungen des Rückenmarks, welche die Fortleitung der sensiblen Reize—ihre Ableitung auf den zweiten Fortsatz der Spinalganglionzelle—verhindern, bedingen eine Anhäufung von Reizen in den Zellen der Spinalganglion, welche seine trophische Funktion krankhaft umstimmen, sodass es zu einer pathologischen Steigerung der Ernährungsvorgänge in der Peripherie kommt.

"Ebenso können die Affektionen der peripherischen Nerven, welche nicht mit einer vollkommenen Leitungsunterbrechung einhergehen, Reizzustände bedingen, die sich auf das trophische Zentrum fortpflanzen und seine Funktion dahin umstimmen, dass es zu Ernährungsstörungen in dem entsprechenden Nervengebiet kommt."

The above paragraphs indicate that not infrequently vasomotor and trophic diseases may be associated with organic lesions of the brain cord, sympathetic system, or peripheral nerves. It is important therapeutically to emphasize their relations with affections like hysteria and neurasthenia, in which disturbances of the sympathetic system are so common. Personal idiosyncrasy plays an important rôle in vasomotor instability, and the tendency is not uncommonly inherited; certain infections, as influenza; poisons, like alcohol or lead; disturbed internal secretions, as of the thyroid; constitutional affections, like gout; disorders in the sexual sphere, masturbation, castration, the climacteric, may play a similar part.

The vasomotor symptoms are either regional hyperemia and edema or local syncope or asphyxia. Trophic disturbances are expressed by gangrene, by pigmentation or induration of the skin, by abnormal overgrowth of a part, or by atrophy.

RAYNAUD'S DISEASE

In 1862 the French physician, Maurice Raynaud, first wrote of the symptom-complex for which Laveran later proposed the name "Raynaud's disease"; his further publications appeared in 1872 and 1874. In its typical form the affection is characterized by paroxysmal vasomotor disturbances, most often symmetric, and affecting the hands, feet, or more rarely the nose, ears, cheeks, lips, mammæ, and buttocks. The onset may be sudden, but is usually gradual and ushered in by paresthesia and more or less pain. The first stage is most often one of local anemia or syncope, during which the affected parts become blanched, cold, and are the seat of considerable or intense pain. Then follows a gradual discoloration of the parts through varying shades of purple and blue to almost inky black—the period of local asphyxia or "regional cyanosis." Pain is more severe, and may become unbearable—the affected area feels deadly cold; sensation may be dulled, absent, or there may be hyperalgesia. Discoloration after a few minutes may gradually give way to return of normal color, the part first affected being, as a rule, first restored, the cyanosis changing to purple, pink, and being followed often by hyperemic redness; or resolution may be delayed and the third stage or local gangrene may follow the vasomotor symptoms. Small blisters appear on the ends of the fingers, the under surface of the toes, and either break, leaving slowly healing ulcers, or dry up, with formation of hard, brownish-black crusts which later separate with slight losses of substance.

The vasomotor symptoms may be most varied, and not follow in the usual sequence. There may be local syncope alone (dead fingers), or local syncope followed by local hyperemia and not asphyxia. Or asphyxia may be established without preceding anemia; according to Monro, it is the most constant stage, occurring in 94 per cent. of cases. Gangrene may be absent in many instances; rarely it may occur without previous vasomotor symptoms: it may be a feature of the first attack or appear only after long continuance of the affection. The individual paroxysm may last a few minutes or even hours or days. There may never be more than one attack (Weiss, in 71 per cent. of cases) or the paroxysms may be repeated with remarkable periodicity for days and weeks, or irregularly over months and years. With successive appearance of gangrene mutilation may finally become extensive. Pain is usually a marked feature, and may precede, accompany, or follow asphyxia; it is irregularly localized in the parts affected, and does not follow distribution of peripheral nerve or nerve-roots; rarely it may be absent. Objective sensory changes are usually present, and are more marked during syncope than asphyxia. Weiss noted partial dissociation of sensation, and thermoparesthesia and loss of temperature sense have been noted. Hyperidrosis of the affected parts is not infrequent. In long-standing cases a certain amount of vasomotor atrophy may occur (Cassirer, Luzzatto). Between attacks the patients usually suffer little inconvenience, except from affections which may cause or accompany the disease.

The most important factor in etiology is the indefinite condition to which the name of "neuropathic constitution" is given; the varied causes of vasomotor instability cited above may favor the development of Raynaud's disease. The disease occurs more frequently in women, most before thirty, and is common in children. Nerve shocks, exposure to cold and wet, trauma (Brasch, Dehio, Schaeffer), infections—as typhoid, influenza, malaria—may be predisposing causes. The symptom-complex may be an associate of most varied conditions: of functional disorders—hysteria, neurasthenia, epilepsy—of organic nervous disease, as hemiplegia, tabes, syringomyelia, multiple sclerosis; of malaria; of infections like syphilis, influenza, tuberculosis; of nephritis, diabetes, arteriosclerosis, lead-poisoning, exophthalmic goiter.

The frequent occurrence of hemoglobinuria in the course of Raynaud's disease is of interest from the standpoint of pathogenesis. Hutchinson first drew attention to the association in 1871, and Barlow emphasized points of similarity in the two affections. Osler mentions a case of the disease with hemoglobinuria and epilepsy in which exposure to cold would precipitate an attack. Hematuria has been described by Hutchinson, Blaud, and Solis-Cohen. The writer has seen a man of forty in whom plunging the hands in ice-water would be followed by local syncope and asphyxia and hemoglobinuria. Very frequently there is evidence of vasomotor instability, either in the form of some definite symptom-complex, as erythromelalgia, scleroderma, or acroparesthesia, or manifested by less obvious symptoms—flushing, urticaria factitia, angioneurotic edema, vertigo, nausea, tachycardia, faintness. Such symptoms may also usher in an attack.

The chief pathologic changes found at autopsy or from examination of amputated extremities have been in the peripheral nerves, arteries, and veins. Cassirer, Remak, Monro, and others are of the opinion that these changes are secondary and not the cause of the affection. The syncope and asphyxia depend upon vascular spasm. Barlow has noted varying contraction in veins during the stage of asphyxia. Raynaud described amblyopia associated with spasm of the retinal arteries, and his observation has been confirmed by Blaud, Morgan, Stephenson, Roques, and Calmette. Transient aphasia or cortical epilepsy and monoplegia probably depend upon regional cortical ischemia. The radial pulse usually does not change during an attack, but absence of the pulse has been noted by Grasset, Bernhardt, Calwell, and others. Cushing found no change of blood-pressure during a paroxysm. The gangrene is not the result of the vasomotor disturbances alone, but represents a definite trophic lesion. It may rarely be extensive and involve entire phalanges, fingers, or even members; associated arterial changes naturally increase the gravity of the condition.

The weight of opinion favors Raynaud's original hypothesis that the disease is an affection of vasomotor -trophic centers. As seen above, it may be an independent affection or a symptom-complex associated with varied conditions. The vasomotor centers may be rendered unstable in many ways, and irritations may reach centers or paths in the brain, cord, or periphery, and so lead to different combinations of symptoms and different types of the disease.

The course of the disease is almost impossible to foretell. Raynaud pointed out that cases with gangrene were less apt to have repeated paroxysms. In the majority of cases there is but one attack. Attacks marked by local syncope and asphyxia alone may recur through a period of thirty or forty years. Raynaud gave the average duration of cases of medium severity as several months. During an attack the most intense asphyxia may exist without gangrene as a sequence. Attacks in children are often severe. The prognosis is, on the whole, not unfavorable. With frequent paroxysms pain is not without influence on the general nutrition, but death is hardly ever attributable to the disease.

Prognosis is naturally colored greatly by associated conditions; the above has reference to independent forms of the affection. Combinations with scleroderma and sclerodactylia or with erythromelalgia may occur.

From the conception of the disease it is evident that treatment will aim chiefly at combating the causes of vasomotor instability and increasing the resistant power of the individual. Children with family history of hysteria, epilepsy, gout, migraine, or vasomotor neuroses must be encouraged to live outdoors, be kept free from emotional influences, and be watched carefully in regard to abnormal sexual habits. Warm salt baths followed by sponging or douches, and artificial Nauheim baths, act as tonics to the vasomotor system. Massage, gymnastics, and outdoor exercise are of benefit. Coffee, tea, alcohol, and tobacco should be used only moderately or not at all by patients with Raynaud's disease, but at times during a paroxysm alcohol may be of service. The diet should be a liberal one, containing plenty of fat. Meat need not be greatly restricted. As in many neurasthenics, it is wise, if possible, to have milk or other simple food taken between the regular meals. Barlow has emphasized the occurrence of attacks after a very hearty meal. Constipation seems also to have some effect in determining paroxysms, and is to be counteracted. In the rare cases in which malaria or syphilis seems to be a causal factor, specific treatment is in order. Quinin occasionally has seemed of value in cases not malarial. The great influence of thermic irritations on the vasomotor system is a matter of every-day observation, and patients with Raynaud's disease may precipitate an attack by exposure to cold. Sudden changes in temperature and exposure to damp cold seem of greatest influence, and some patients do well in cold but dry climates. It is a fact frequently to be noted that patients from San Francisco (which has an equable but damp climate) with mild degrees of local syncope and asphyxia are more comfortable during the dry cold of an eastern winter than at home. Warm clothing is to be recommended, and in women it is well to insist on proper covering for the extremities. Frequently a linen mesh undersuit with a light woolen suit over it is more comfortable than heavy woolen underclothing; in two cases of Raynaud's disease in men linen socks with light woolen socks over them seemed of definite advantage. Mittens are better covering than gloves for the hands. Plicque has advocated protecting the threatened parts with fatty ointments.

Raynaud enthusiastically believed that by means of electricity he could influence the morbidly irritated centers in the cord and lead to vascular relaxation in the periphery. Barlow emphasizes the value of continued galvanism and friction in the prevention of severe attacks, and is an advocate for electric treatment of the attack. He places the affected extremity in a basin of warm salt water, and applies one pole of the galvanic current above the affected area, placing the other in the water. The current is frequently made and broken and is strong enough to make distinct contractions. Although either this or the faradic water-bath may relieve pain, and at times the vasomotor symptoms, electricity often fails in modifying the disease in any way; the length of time during which treatment must be continued greatly limits its usefulness. During the last years good results have occasionally been reported from the use of high-frequency currents. The use of strong currents and the faradic brush during a paroxysm is to be discountenanced.

Cushing has lately advocated the systematic use of compression to counteract excessive vasomotor action, and to give rise to reactive hyperemia from temporary palsy of vasomotor influences below the area of compression. Courtenay had previously advocated the use of a tourniquet, and Cassirer records that he has for some years been using with benefit compression by means of a flannel bandage to the point of distinct venous stasis. Cushing uses the convenient arm-band of a blood-pressure instrument, and shuts off the arterial circulation for several minutes. The extremity flushes after releasing the pressure, and pain is relieved. Osler records several cases markedly benefited by this procedure. Schwab saw immediate relief of pain and disappearance of gangrene after a few days in a case that had had frequent attacks over a period of six months. This would seem by far the most convenient method of treatment during an attack. Parts like the nose or ear could be treated with the method of Bier to produce local hyperemia. All irritating applications to the parts must be avoided. Raynaud recorded the bad results of a mustard bath. Moderate dry heat may be safely used, and relief may be had by wrapping the extremities in cotton or wool.

Drug treatment is most unsatisfactory. Iron, arsenic, and quinin will be useful tonics. Bromids may be of indirect value in some instances. Nitrites are without influence. Alcohol may be of service during an attack, but may be advantageously replaced by hot tea or hot water. Solis-Cohen advocates adrenalin, but it is a drug to be used at all times with caution.

In hysterical cases suggestion may be of value (Tesdorf, Gilles de la Tourette). Souques reports a cure through use of methyl-blue as a means of suggestion in a hysterical man; a similar case has been under the writer's notice.

Severe pain will often demand morphin. Hypodermic injections should not be given in the affected parts. Monro advocates the use of opium over a long period of time in old patients with frequent and severe attacks.

Gangrene will usually require no treatment beyond keeping the parts dry and clean; should it be extensive, the usual rules of surgery must be followed.

ERYTHROMELALGIA

In 1872 Weir Mitchell described an affection which, in his own words, is "a chronic disease in which a part or parts of the body—usually one or more extremities—suffer with pain, flushing, and local fever, made far worse if the parts hang down." The affection is a rare one, somewhat more common in men, and may occur at any age. Baginsky noted it in a boy of ten, and Woodunt in a man of seventy-three. The influence of thermic irritations is apparent here, as in Raynaud's disease. Weir Mitchell's first patient was a sailor. Lannois emphasized particularly the effect of damp cold. An engineer described by Mackenzie was constantly exposed to heat in the upper half of the body, while his feet were often in cold water. In an interesting communication Gerrard mentions six cases occurring in Malay laborers who worked standing in water for many hours daily; the soles of the feet and toes were chiefly affected. Stress is to be laid also on overexertion, particularly of a group of muscles. A patient of Weir Mitchell had been using a geologic hammer constantly. In a soldier described by Lannois the disease appeared after excessive marching. Sachs and Wiener assert that it is not infrequently seen in tailors. Previous infections, except perhaps as they are of influence in favoring arteriosclerosis, as syphilis, play no rôle in etiology. In a few instances trauma was followed after a short interval by symptoms of erythromelalgia in the injured part (Mitchell, Shaw).

In a number of cases there is association with organic nervous disease. Weir Mitchell describes it with hemiplegia, Edinger with tabes, Pospelow with syringomyelia, Woodunt with probable tabes. Collier cites six cases of multiple sclerosis, two of tabes, and a case of chronic myelitis with erythromelalgia. The writer has under observation for some years a man of forty-five in whom erythromelalgia in the right foot seemed to be the only affection over a period of three years. Later lightning pains in both extremities were noticed; gradually the Achilles and knee-jerk on the right disappeared, and there is now bilateral loss of knee- and Achilles jerks and Argyll-Robertson pupils. Not a few cases described in literature as erythromelalgia more properly belong under the heading of endarteritis obliterans or of intermittent claudication; cases with gangrene are particularly open to criticism. Schmidt described the condition in a woman of sixty, clinically the counterpart of erythromelalgia affecting at different times three extremities; there was a splenic tumor, arteriosclerosis, and an erythrocyte count of 10,000,000. Parkes Weber recorded a count of 9,000,000 reds in a woman of thirty-six with erythromelalgia of both feet over a period of three years.

Pain is the most prominent and usually the first symptom; in the fully developed disease it may be tormenting. It is usually described as aching, boring, or burning; it is not infrequently preceded and accompanied by paresthesia, often thermoparesthesia. After some weeks or months of pain redness appears; in a few instances it has preceded pain. The part affected has all the appearances of active hyperemia—the pain and redness are increased by hanging down, by warmth and exertion; there is heat, throbbing, and may be swelling; sweating may be a feature. In not a few instances the affected area has been incised under the idea that there was deep-seated inflammation.

In the beginning, particularly in young people, the attacks are intermittent, and come only on the exposure to heat, after overexertion, or after the affected part has been kept hanging down. Later attacks last from hours to days or weeks. In chronic cases there may be transition from the condition of active to one of passive hyperemia;

the areas become cyanosed, cold, and often thickened, with trophic affections of the skin, nails, and even bones. There is occasional transition to or association with Raynaud's disease or sclerodactylia. Gangrene does not occur except in cases with arterial changes—in symptomatic rather than pure erythromelalgia. During the painful period there is usually great hypersensitiveness; the patient anxiously avoids all pressure, and may drag himself about on hands and knees rather than attempt to walk. The feet are affected about twice as frequently as the hands. Pain and redness first appear, as a rule, in the balls of the toes or about the heel, but, as time goes on, other parts of the extremity, or even other extremities, are involved. The areas affected are usually not symmetric; unilateral distribution is frequent. The areas are most often irregular, patchy, but may follow definite peripheral nerve distribution, and French authors have described a segmental distribution. Weir Mitchell holds that erythromelalgia may attack any part of the body, and thinks even muscles or intestine may be affected. Benda described patches in the mastoid region and the back of the neck; Seeligmüller, an involvement of head, neck, and mucous membrane of mouth, throat, and gums. Cases described by Schmidt and Parkes Weber are closely related to those of chronic cyanosis with polycythemia and enlarged spleen. The peculiar patchy or at times diffuse red swelling of extremities called "erythromelia" by Pick resembles erythromelalgia except that it is not accompanied by pain.

Pathologic anatomy has not thrown much light on the true nature of the affection. Death does not occur directly from the affection; a patient of Mitchell succumbed during a second operation for gangrene that followed nerve excision and stretching. The causes of death reported have been chiefly cerebral hemorrhage, general paralysis, uremia. In a man seen by the writer in 1904 death was due to angina pectoris; the arteries of the feet—the parts affected—had pulsated plainly throughout the affection.

The most constant changes have been noted in the peripheral arteries, particularly in their terminal branches. Shaw, from the examination of amputated parts in three cases, lays particular stress upon thickening of the walls of both arteries and veins. Mitchell and Spiller noted a reduced number of nerve-fibers and increased fibrous tissue in some of the nerve-bundles in one case. The reports of Sachs and Wiener, Lannois and Porot, and others deal rather with a condition like that of intermittent claudication and arterial gangrene than true erythromelalgia. Auerbach, in a most complete examination, found nothing but moderate changes in the posterior roots. The fact that long-continued vascular dilatation may lead to thickening of the intima (Thoma), and that neuritis may cause terminal arteriosclerosis (Lapinsky, Fränkel), must be borne in mind in utilizing the above reports to found a hypothesis as to the nature of the disease.

The evidences of active hyperemia seen in the affected part, and symptoms occasionally noted, such as headache, vertigo, flushing of the face, painful erections, and swelling of the testicles, suggest a morbid irritation of vasodilator fibers. The not infrequent association with spinal affections and the prominence of sensory phenomena suggest that the abnormal irritation may take place in the vasomotor centers in the cord. In other cases the localization to areas of peripheral nerve distribution, the local changes found in vessels, and to a lesser extent in peripheral nerves, would speak for an irritation of vasomotor, trophic, and sensory paths or centers by morbid influences coming from the periphery (Weir Mitchell, Cassirer).

From the nature of the affection it is apparent that there can be no question of any specific therapy. The prognosis is always a doubtful one. In many cases pain fortunately becomes less severe as months and years pass. A few instances of complete cessation of the process have been recorded (Morgan, Sigerson, Grenier Personali). Weir Mitchell writes disheartedly of the futility of all ordinary therapeutic measures. Something may be done to prevent attacks by avoiding overexertion, exposure to heat, and by keeping the affected part elevated. A man seen three years ago with Reynolds was comfortable during two winters in the Klondike. The chief therapeutic indication is the relief of pain. This can be fulfiled in part by rest and elevation of the part. The application of cold is, as a rule, grateful—sponging with cold salt solutions or with cold sea-water, or the application of cold lead and opium solution. A 10 per cent. alcoholic menthol solution has seemed occasionally of advantage. Bernhardt and Prentiss warn against the excessive use of cold—a warning which is emphasized also by the influence of this factor in etiology.

Electricity is of little value, save that some comfort may be derived from the galvanic tub-bath. In one instance of symptomatic erythromelalgia associated with intermittent claudication cocainization of the external popliteal nerve on two occasions by the writer gave relief for a period of some weeks. Alcohol may help during an attack (Cassirer, Mitchell); one of Mitchell's patients became a drunkard from its continued use as a method of relief. Cannabis indica, phenacetin, or antipyrin will occasionally relieve exacerbations of pain, but most reliance will have to be placed upon opium. Opium may even have curative influence; Morgan cites recovery in a severe case after three weeks' use of morphin and atropin hypodermically. Levi reported cure of a hysterical case by hypnotism; Oppenheim tried suggestion in a patient with marked hysteria combined with erythromelalgia, but without result.

Realizing the futility of drug treatment, and with the idea that the process might have origin through influence on vasomotor and sensory centers by morbid peripheral irritations, Weir Mitchell counseled nerve excision and stretching in one of his cases. Operation by Keen consisted in excision of 2½ inches of the musculocutaneous and two branches of the internal saphenous, and stretching the plantar branches of the internal saphenous. Relief was immediate and permanent. In a second case gangrene followed operation. Mitchell advocates now the stretching of all nerves to the affected area, and excision only if relief does not follow this procedure. Cassirer also favors nerve-stretching in obstinate cases. Amputation has been done for the relief of persistent and seemingly hopeless painful states. In a few instances the affection has made its appearance in other parts, so that the less radical measures mentioned above should first be attempted. Shaw not long since reported three cases of amputation (two of the hand and one of the foot), with complete relief of symptoms.

ACROPARESTHESIA

In 1890 Schultze suggested the name acroparesthesia for a group of affections characterized chiefly by peculiar sensations, and even pain, in the extremities. Nothnagel had already written on the subject, emphasizing particularly the frequent occurrence of vasomotor symptoms with the sensory phenomena. Putnam and Dana described the condition under the heading of "the paresthetic neurosis." Saundby, Shaw, Omerod, Collins, Raymond, Déjérine and Eggers, Pick, Bernhardt, Fränkel-Hochwart, and Cassirer have written extensively on the subject. The affection is not uncommon, and is encountered five times more frequently in women than in men. In a series of Fränkel-Hochwart there were 150 women and 12 men. Cassirer, in 90 cases, noted its occurrence 10 times in men. Out of 100 cases published by Collins, 31 were men—many of them tailors and Jews. Many cases are met with in washerwomen, laundresses, seamstresses, and tailors, so that overuse of the hands and constant irritation by cold water are definite etiologic factors. The affection is far more common after thirty than before; Collins gives as the period of greatest frequency the decennium between forty and fifty. The influence of sexual disturbances is marked, and the vasomotor instability during the menopause seems a distinct favoring cause. Cassirer made the interesting observation that in four or five instances the affection developed soon after ovariotomy. Saundby and Shaw lay stress upon the influence of gastro-intestinal disturbances, particularly constipation. Alcohol, tobacco, and coffee occasionally have been accused.

The onset is usually gradual, but may be sudden. The fingers are most commonly affected, and complaint is made of numbness, prickling, crawling, burning, or coldness, clumsiness, stiffness, a "wooden" or "dead" feeling. There may be occasional, or more continuous, decided pain. As a rule, the sensations come and go, and may be repeated in definite paroxysms; the early morning hours mark, frequently, the time of greatest discomfort. As a rule, paresthesias do not extend much beyond the fingers. All four extremities may be involved or only the hands, or but one hand and separate fingers. Cassirer emphasizes the irregular distribution, not in areas of peripheral nerve-supply. Déjérine and Eggers, Bick, and others have, however, described instances of radicular distribution of paresthesias and objective sensory changes. Friedman has laid stress upon the frequent limitation to the ulnar area. Not long ago the writer saw a woman of sixty with the affection symmetrically distributed over the forearm and in the thumb and first and second fingers in the sixth and seventh cervical root areas. There were associated hyperesthesia and hypalgesia, and occasional local syncope and asphyxia. Most often objective sensory changes are expressed by slight degrees of hypesthesia, and limited to the tips of the extremities. Fränkel-Hochwart described hypalgesia extending to the shoulder; Cassirer, however, has seen no case with hypalgesia reaching to the wrist. The objective sensory findings may vary in different attacks.

Cassirer would make a separate division to include cases such as first described by Nothnagel, in which vasomotor disturbances are plainly apparent. Pallor and coldness of the extremities, "dead fingers," varying degrees of cyanosis, local syncope, have at different times been observed. The combination with Raynaud's disease is rare.

Sinkler would refer the disturbance to an altered blood-supply of the cervical cord, and Pick also would localize it in the lower part of the cervical cord. Schultze thought it an affection of the nerve terminals of the skin; Friedman and Edinger, a peripheral nerve irritation due to disordered circulation. Cassirer, in light of the etiologic factors, regards the peripheral localization as most probable, and explains the symptoms by an irritation of the skin and vessel nerve-endings. Déjérine and Eggers, from the radicular distribution, suppose an irritative lesion of the posterior roots in their intramedullary course; they refer the paresthesia to both sensory and vasoconstrictor irritation.

The affection usually lasts for months or years, although Friedman speaks of an acute form of sudden onset and short duration. There are frequent periods of comparative or total freedom, but any new exposure to the causal influences may be followed by return of symptoms; cases are recorded of twenty or thirty years' duration. The general health of the patients is very little affected, and the condition is serious chiefly by reason of its persistency and interference with modes of livelihood. It is well here to emphasize the fact that paresthesias may be the first sign of an organic nervous affection (tabes, lues cerebrospinalis, encephalomalacia), or may occur in the course of a general affection, like gout, nephritis, or myxedema.

Treatment has to consider chiefly the etiologic factors. Patients must be kept free from the harmful thermic irritations and the effects of overstrain. Anemia must be corrected and proper care taken of nutrition. No absolute rules can be made in regard to diet, and this must be regulated largely by the personal equation of the patient. The use of alcohol, tea and coffee, or tobacco should be restricted. Saundby laid much stress upon the influence of constipation and intestinal fermentation, and found most service from the occasional administration of calomel and rhubarb. The resistant power of the patients will have to be increased by avoidance of nervous wear and tear, by mild hydrotherapeutic measures, by massage, and by the use of tonics, of which iron, quinin, strychnin, and arsenic are the most serviceable. Bromids are occasionally of value in controlling the vasomotor irritability.

The pain and paresthesia frequently call for direct treatment. The faradic brush, static spray and sparks, and high-frequency currents often definitely relieve. Warm salt baths, the artificial Nauheim baths, hot-air baths, and the electric cabinet bath, followed by quick sponging with cool water and brisk friction, help both the symptoms and the general condition. Fränkel-Hochwart strongly recommends massage. Sinkler saw good results from the use of ergotin, but Collins and others used it without effect. Quinin, given in doses of 0.3 to 0.5 gm. at bedtime, has been of service in the hands of Oppenheim. Collins recommends the administration of sulphonal at bedtime in the cases of annoying early morning paroxysms. In a few instances of annoying paresthesias in stout women, with signs suggesting beginning myxedema, thyroid extract has been of distinct value to the writer. The clinical picture was that of acroparesthesia. With marked arteriosclerosis iodids should be given.

MERALGIA PARÆSTHETICA

In 1895 Bernhardt, and a little later Roth, described a clinical entity for which Roth proposed the name "meralgia paræsthetica"; the affection has also been termed "neuralgia paræsthetica" and "Bernhardt's disease." From the number of cases collected by Sabrazes and Cibannes, and by Musser and Sailer, it would seem fairly common. The symptoms consist of paresthesia, pain, and objective sensory changes on the outer surface of the thigh, in the territory of the external cutaneous nerve. In rare instances (Roth) the sensory changes may involve the front part of the thigh also, in the area supplied by the anterior crural. As a rule, paresthesia of moderate degree, numbness, and tingling form the chief complaint; but at times there may be bothersome burning or even severe pain. Pain is increased by standing or walking, and nearly always relieved by lying down and flexing the thigh. The paresthesia may persist, however. The objective sensory changes consist usually of varying degrees of hypesthesia and hypalgesia; temperature sense is but rarely affected; at times there may be tender points along the course of the nerve.

Men are more frequently affected than women; Musser and Sailer noted 75 men and 21 women in their series. The condition is even much more common after thirty than before, and is frequently met with in advanced ages; Schlesinger collected 11 cases over sixty and 2 over seventy. The writer has seen it develop quickly after trauma in a man of seventy-two. Trauma is a frequent cause, and was noted 21 times in 112 cases (Schlesinger); blows, strains, and falls have been most often accused. Continued standing or climbing and long-distance walking have also been described as etiologic factors, as have also alcohol, obesity, diabetes, gout, and varied infections. The affection may be a symptom of organic nervous disease, and has been described in the course of tabes, hematomyelia, and general paralysis.

The writer has twice seen it a marked feature of tabes; in one instance bilateral paresthesia and hypalgesia in the territory of the external cutaneous nerves occurred as symptoms of cerebrospinal syphilis, and were definitely improved by specific treatment. In a case of intermittent claudication observed by the writer the disturbances were chiefly referred to the same area; Brissaud has noted a similar distribution.

The affection is not infrequently bilateral (23 times out of 100, Schlesinger). The anatomic relations of the nerve explain in great part why it is so frequently involved. It can readily be injured as it emerges from under the psoas, or just below the anterior superior spine, or in the fibrous sheath of the fascia lata, or as it emerges from this fibrous canal (Roth). The nerve is particularly exposed to stretching and pressure when the fascia lata is tense, as in standing; Pal, Kahane, and Ehrmann have emphasized the influence of flat-foot. The pathologic changes in the nerve have been variously described. Dopter described a case due to pressure of a tumor; Nawratski found well-marked neuritis and perineuritis; Warda and Hager noted definite thickening. In a few instances the nerve has been found normal, and the clinical course of many cases would suggest that the underlying lesions must be but slight.

The development of symptoms is gradual, as a rule, but once established, the affection is often obstinate and may last for months or years. Many cases are brought to light incidentally in the course of routine examination, as symptoms have not been obtrusive enough to bother the patients. In a few instances paresthesias are intensely disagreeable, or pain on standing or walking is so severe as to incapacitate the patient.

The indications in treatment are to remove abnormal pressure or tension by rest, flexion of the thigh, and perhaps by adjustment of flat-foot plates. Associated syphilis, diabetes, or alcoholism must be properly treated. Massage and irritation with the faradic brush are the most effectual means of combating the subjective disturbances, or static electricity may be of advantage. The application of a 10 per cent. alcoholic solution of menthol has been of advantage in several instances. Iodids or nitroglycerin continued over a long period of time may be of service. In a few cases in which pain was so marked a feature as to prevent walking and seriously to affect the general health, resection of the nerve has been tried (Souques, Chipault, Hagen, Brissaud, Wandsbeck, Sollier). The results have been, on the whole, satisfactory. Pain disappears, though not immediately after operation in some cases. It may return later, but with lessened intensity. Operation will, of course, not be attempted in cases in which the symptom-complex is but part of an organic nervous disease like tabes.

ANGIONEUROTIC EDEMA

Graves in 1848 gave a good description of this affection, which was, however, first thoroughly impressed upon the profession's attention by

Quincke in 1882. It is characterized by swellings in the skin, subcutaneous tissues, mucous membranes, and even serous cavities, which occur, as a rule, suddenly and without prodromes other than general discomfort, loss of appetite, depression, chilliness. The swellings vary much in extent, from the size of a pea to involvement of an entire extremity or half the face; Quincke gives the average diameter as from 2 to 10 cm. The borders may be sharply defined or shade diffusely into the surrounding tissues; the color is usually whitish or waxy, or at times with reddish shades, more like urticaria. The center may project half an inch or more above the level of the surrounding skin. There are few subjective disturbances from the elastic skin tumefaction beyond a feeling of fullness and tension, stiffness, or slight burning or itching. Intense pruritus is uncommon, and marks transition to true urticaria. Objective sensory changes are not found. Almost any part of the body may be involved, but the face, extremities, and genitalia are most often affected. The swellings are seldom symmetric; they may be unilateral or follow a segmental distribution, but usually are utterly irregular. They may last a few minutes only, a few hours, or several days. There is a pronounced tendency to recur, and the original localization is apt to be involved in each subsequent attack. The mucous membrane localizations may give marked symptoms. Swellings of the tongue or palate cause great discomfort; those of the larynx may be a direct cause of death. Paroxysms of sneezing, croup, some forms of vasomotor asthma (Schlesinger), intermittent exophthalmos (Fuchs, Adler), some forms of meningitis serosa (Quincke), joint and tendon-sheath swellings (Schlesinger), have been described as modified forms of angioneurotic edema. Gastro-intestinal symptoms are seen in 34 per cent. of cases (Collins); there may be slight discomfort and nausea, or severe colic and vomiting, or marked meteorism and profuse diarrhea. The attacks may be associated with the skin swellings, or may occur independently.

The affection is not uncommon, occurs a little more frequently in men, and more often before forty than after. It shows often remarkable hereditary tendencies. Osler saw it in twenty-two members of five generations; Mendel and Schlesinger through four generations. The ascendants may show other neuropathic taint—hysteria, epilepsy, migraine. The patients not infrequently show other evidences of unstable nervous system, and indefinite rheumatic or gouty affections have been mentioned as associated by many authors. Alcohol in a few cases has precipitated attacks. The ingestion of fish, strawberries, and other foods has been accused, but the evidence is not so conclusive as in the case of urticaria. The influence of cold is indisputable both in bringing about the swellings and in determining their localization. Insect-bites may be a cause, but the influence has been much exaggerated in the popular mind. A sudden change from the mountains to the seashore has seemed to precipitate attacks several times in the writer's experience. Loewenheim thought of an infectious origin from observation of an endemic occurrence in Silesia; the prevalence of the affection in San Francisco two years ago was most notable. The influence of menstruation, pregnancy, and the menopause as exciting causes has without doubt been overrated by most writers. In the course of exophthalmic goiter or myxedema transitory swellings are not infrequent, and it is important to remember that they may be an early symptom of organic nervous disease—tabes, tumors of the cord, syringomyelia.

Pathogenesis of the affection centers in discussion of the causes of neuropathic edema, and most authorities share the view of Heidenhain that capillary cells play the chief rôle in lymph formation, and that morbid nerve influences may lead to excessive secretion and production of swelling. The experiments of Loeb and MacCallum suggest that chemical processes must be assigned in future a more important part. In many instances a few slight skin swellings constitute the entire affection, or there may be recurrent slight attacks, with skin and mucous membrane localizations. The family forms of the disorder are more apt to appear at an earlier age and show a wider range of symptoms. In some instances attacks recur over years, and become a trial and even a menace to the patient. A number of deaths have been reported from edema of the glottis. Osler mentions two; and Mendel records six fatalities occurring among twelve members of a family afflicted through four generations by the affection.

With the idea that abnormal innervation is the chief factor in producing angioneurotic edema, treatment will consist chiefly in removal of physical or psychic causes that tend to keep nerve resistance at a low ebb, and in the employment of such aids as hydrotherapy, massage, and exercise. Known idiosyncrasies of the patient in diet must be respected, and much good may be done by regulating constipation with salines, like sodium phosphate or Carlsbad, with occasional small doses of calomel, or a capsule at bedtime containing a little rhubarb or compound extract of colocynth. It has seemed to the writer that ichthyol in doses of 0.3 to 1 gm. in keratin capsules after meals has been of occasional distinct benefit. Higier recommended menthol and camphor. Since the publications of MacCallum on the action of calcium salts in controlling lymph secretion, the writer has been using calcium chlorid or calcium bromid, 0.6 to 1 gm. three or four times daily, with good result; the same method of treatment has been of advantage in cases of skin and mucous membrane symptoms following injection of antidiphtheritic and antistreptococcic serums.

Osler has seen benefit from the long-continued use of nitroglycerin. Collins advocates strychnin in large doses; Higier praises arsenic, and Dinkellacker and Quincke saw good results from the hypodermatic use of atropin. Quinin has been recommended warmly, and Oppenheim speaks of two cases cured and one much helped under its administration.

For relief of the swellings collodion may be tried or compression by an elastic bandage. High-frequency currents influence subjective symptoms favorably and seem to have some effect in preventing return of the tumefaction. Severe gastro-intestinal symptoms will require morphin hypodermatically. In a case with severe colic seen not long ago, calcium chlorid, 1 gm. in solution, seemed to have almost immediate effect. If the affection occur in the course of exophthalmic goiter or myxedema, or as a symptom of organic nervous disease, treatment will be directed to relief of the underlying condition.

Edema of the glottis may require scarification or tracheotomy. Fortunately the condition often subsides quickly even after the onset of alarming symptoms. Painting with calcium chlorid solutions or spraying with adrenalin 1 : 10,000 should be tried.

SCLERODERMA AND MORPHEA

The peculiar changes to which this affection owes its name consist in hardening of the skin and subcutaneous tissues, leading to a condition well described by the common name "hide-bound." The folds of the skin disappear, the part looks glossy and waxy, feels hard, stiff, and "woody," and may show abnormal coloring or loss of pigment. The changes may be diffuse, involving the greater part of the body, or in irregular patches, or in bands or rings, may follow the distribution of peripheral nerves or of spinal segments (Brissaud). The face, neck, thorax, and arms are the localities most often involved. Occasionally a strictly unilateral distribution has been described. Parts exposed to pressure are not infrequently affected—the forehead from pressure of the hat-band, the neck from irritation of the collar, areas about the waist-line from friction of the clothing.

Since Kaposi it has been customary to distinguish three stages of the process—the edematous, indurative, and atrophic. In the first stage the part affected is elevated, elastic, and may be hyperemic, but, as a rule, patients will not be seen until induration of the skin has become marked. If the face is involved, the features become small, pinched, and expressionless. If the hands are predominately affected, "sclerodactylia," there is often atrophy, stiffening, and deformity of the fingers, accompanied by vasomotor disturbances like those of Raynaud's disease. Induration and atrophy may affect muscles, bones, and internal organs. The process in the deep parts, especially in the muscles, may proceed independently of overlying skin changes; there may be extensive myosclerosis under intact skin (Rosenfeld, Eliot, Westphal, Schultz, Chauffard, Crocker). Dercum has demonstrated bone changes by *x*-ray examination. The joints are frequently affected, either by limitation of movement by the shrunken, atrophic skin, or by the share of ligaments in the process, or by progressive changes resembling rheumatoid arthritis (Dercum); so-called "rheumatic" joint pains are frequent prodromes or accompanying symptoms.

There may be hyperidrosis of the affected parts, or more often anidrosis. Vasomotor symptoms are common, and may long precede the indurative stage; there may be all gradations, to a pronounced Raynaud symptom-complex. Pigmentation may be pronounced, may vary in distribution and intensity, may precede the characteristic skin changes, and at times may be so deep as to lead to confusion with Addison's disease. The name morphea is given—particularly by English writers—to circumscribed patches and bands, often surrounded by a halo of varying shades of brown or lilac. Since the paper of Hilton Fagge and the anatomic researches of Crocker the process has become recognized as closely related to, if not identical with, the diffuse variety. Alopecia, desquamation, loss of teeth, changes in nails, and trophic ulcers have been observed. Subjective complaints may consist of paresthesia, itching, and pain; objective sensory changes have rarely been observed. Association of the disease with facial hemiatrophy, Raynaud's disease, erythromelalgia, exophthalmic goiter, myxedema, and rheumatoid arthritis have been repeatedly noted.

The affection may occur at any age, although it is more frequent after middle life. In the statistics of Lewin and Heller 67 per cent. of cases were in women. Exposure to cold seems to have a definite influence in etiology, as a few cases are reported with sudden onset after chilling or wetting. Infections do not play any marked rôle. Psychic influences have been emphasized by Lawrence, Lewin, and Shaffer. Varied theories have been proposed to explain the remarkable affection. A local infective process has been advocated. The chief skin changes are found in the corium, the papillæ are flattened, the subcutaneous layer is decreased, and the skin is often bound down to the underlying tissues; masses of leukocytes surround at times the small vessels. Blood-vessels may be markedly thickened, all three coats participating in the proliferation, but there is no parallel between the skin and vessel changes (Lerrede and Thomas). The vascular origin of the process has been supported chiefly by Dinkler, Hoffa, von Notthaft, and Neumann. Brissaud refers it to an affection of the sympathetic. Jeanselme, Hektoen, Singer, and Uhlenruth are advocates of a dysthyroidea as chief factor. According to Cassirer, Leube was the first to point out the association of scleroderma and exophthalmic goiter; Osler, Fox, Gruenfeld, Jeanselme, Dupré and Guillain, and Kohler have noted the same fact. Cases have been seen with myxedema. The occurrence of a struma or of an atrophied thyroid has been noted at autopsy. Roux reported an autopsy on a case of scleroderma and sclerodactylia with changes in the hypophysis. Lymph-stasis plays some part in the process, but, as Kaposi pointed out, cannot be the sole cause.

Most authors still classify the affection as a trophoneurosis; some claim that it is of central and others of peripheral origin. Lewin and Heller speak of an initial stage of vasomotor dilatation with edema and hyperemia, and a secondary period with vascular changes, increase of connective tissue, and final atrophy. According to Cassirer, irritation of the vasomotor and trophic centers may be due to toxic, reflex, or infectious agents. The recovery of chronic and wide-spread forms of the disease is against any permanent organic lesion. The course of the disease is notoriously uncertain. In some instances (most often in young persons) the onset is sudden, and in a short time large areas may be affected; Mohr observed a girl of twenty-one in whom diffuse scleroderma developed within three days over the entire trunk, neck, and face. In some cases prodromal symptoms, chiefly vasomotor phenomena and paresthesias, may precede the skin changes for years. Even after the indurative and atrophic stages have been established, the course may be eminently chronic. Lewin and Heller collected ten cases lasting over fifteen years; Haslund recorded a duration of forty-eight years, Brissaud of over twenty, and Ledermann of thirty years. Circumscribed scleroderma, or morphea, offers a better outlook as to ultimate recovery; most cases eventually get well, but it may be after years, with varying periods of progression and betterment. Diffuse forms may also show varying rates of advancement, and cure is possible even after most extensive induration. Combinations of diffuse and patchy scleroderma (morphea) have been observed by Addison, Gaskoin, Crocker, and Dyce Duckworth. Aubert described complete restoration in a case in which induration and atrophy had existed for several years. Heller observed a case ten years after it had been described by Senator, and found an almost normal condition of the affected parts. In circumscribed forms the outlook is much more favorable in cases with patches than in those with distribution in bands. In the general form improvement is more confidently to be expected in acute cases with predominance of indurative over atrophic changes. Crocker is of the opinion that cases "which are indurated from the first are more favorable than those which are edematous, as they are less likely to become atrophic." As improvement occurs indurated parts often become hyperemic, and pigmentation may mark the place of former whitish or yellowish patches. Sweating may return, growth of hair may be reëstablished, induration of deeper parts may disappear. As a rule, restoration is a slow process, covering periods of months or even years, but Lewin observed a case in which a normal condition of the skin was reëstablished in four weeks. Acute exacerbations are not infrequent in cases apparently quiescent, and have been referred to the influence of mental shock, or of exposure to cold and wet.

The outlook is best in children. Taking all cases into consideration, Lewin and Heller thought a cure could be expected in 16 per cent.; Herxheimer, in 8 per cent.; but the unreliability of statistics in such a chronic and uncertain process is apparent. Sclerodactylia is least liable of all forms to be modified by treatment or time. Joint and muscle changes may greatly limit the patient's activity; changes about the jaws may so lock them as seriously to interfere with nutrition; diffuse affection of the skin over the thorax may impede respiration. In diffuse atrophic forms emaciation and marasmus may develop and the condition prove a direct cause of death; in other cases the weakened patients readily succumb to some intercurrent affection. Owing to the uncertain nature of the disease, to the impossibility to say in each case just what the subsequent course will be, to the tendency toward spontaneous recovery at times, all results of treatment must be judged most conservatively.

The patients must be protected from the action of cold and dampness, as exacerbations not infrequently follow exposure. The usual means will be taken to improve general nutrition, and warm clothing will be insisted upon. With the knowledge that the affection is frequently associated with so-called "rheumatic" phenomena, salol and salicylates have been extensively employed in late years. Philippson writes enthusiastically of the treatment, and Morrow, Osler, Schaeffer, and Buelan have seen some encouraging results; the early stages of the disease offer most hope of being influenced. Salol has been most frequently employed in doses of 1 gm. two or three times daily. With the knowledge of the fairly frequent association of scleroderma and thyroid changes, and of the action of thyroid preparations on skin nutrition, a number of writers believed at first that in thyroid extract had been found a specific treatment for the affection. Singer saw scleroderma associated with exophthalmic goiter much benefited, and Wagner, Weber, Marsh, and others reported favorably influenced cases. Lancereaux and Paulesco reported marked improvement within four months in a patient with diffuse lesions that had resisted other treatment for two years; they gave iodothyrin in dose of 0.5 to 2 or 3 gm. daily. In other cases there was some improvement as long as the thyroid was being given, but this ceased on stopping the drug. In other instances there was no betterment, or the drug caused symptoms of intoxication, and treatment was discontinued. Osler has reviewed the use of thyroid in the disease, and from his extensive experience the results are not very promising. One patient of his has taken the extract during seven years without harm, and the skin process has not advanced; in two cases of circumscribed scleroderma there was some benefit. Osler is inclined to refer some of the improvement to regulation of the diet and mode of living rather than to thyroid. It has been suggested that the favorable results in some cases are owing to the effect of thyroid on metabolism rather than to any specific action (von Notthafft). In properly chosen cases, in which the administration of the remedy can be properly supervised, it seems worthy of a trial.

Ovarian and testicular extract, adrenalin, and extract of hypophysis have been used without noticeable effect.

Electricity has been extensively employed for the relief of paresthesias, to modify the skin changes, and to influence the disturbed vasomotor and trophic centers that are supposed to be causal factors. Brocq reported striking results from electrolysis, and Hallopeau and Darier noted improvement in two cases. Galvanization of the skin near the affected areas seems to have beneficial effect, probably from production of hyperemia, and thus favoring absorption. Care must be taken not to irritate the patches, as extensive ulceration has followed electric treatment in a few instances. Crocker says that any irritation of an indurated area leads to further thickening. High-frequency currents seem definitely to influence the indurated patches favorably, and should be given preference over *x*-ray treatment, which, if tried, must be carefully watched. In cases with marked vasomotor disturbances it is wisest to avoid electric treatment.

Massage and inunctions of oil or ointments serve to improve the general circulation, and seem to exercise beneficial action on the indurated parts. Rubbing must be gentle, and will have to be continued over months or years. Most writers recommend the use of salicylic vaselin, 2 or 3 per cent. Mosler advocates ichthyol vaselin, calcium sulpho-ichthyolate, 0.1 gm. internally three times daily, and tub-baths with 60 gm. ichthyol added. Massage and proper movements may also tend to prevent joint changes and deformities. Baths can be of service only in so far as they are a help to general nutrition. It may be of benefit, in conjunction with massage, to encourage hyperemia by the use of local hot-air baths or hot-air jets to the affected patches. Hebra introduced injections of thiosinamin, and used it in 15 per cent. alcoholic solution, injecting 0.5 to 1 c.c. twice a week in the scapular region. He reported benefit in three cases, which was ascribed to the lymphagogic action of the drug (Hebra, Gärtner, Spiegler). Kaposi and Scholz also recorded encouraging results. From the frequent reports concerning the favorable action of thiosinamin in indurated scar tissue the remedy should be given a more thorough trial in scleroderma. It may be injected in the arm or in the neighborhood of affected areas, as well as in the back. A 10 per cent. solution in 10 per cent. glycerin is less painful than the 15 per cent. alcoholic solution, but has the disadvantage that it must be warmed each time before using; 0.5 to 1 or 2 c.c. should be injected two or three times a week. Suker and Merteus found that the drug has the same action when given by mouth, and it may be administered in gelatin capsules, 0.05 gm. at a dose.

PROGRESSIVE FACIAL HEMIATROPHY

This remarkable affection is characterized by atrophic changes in skin, soft parts, and even bones, which may be limited to a part of the face or involve the entire half; when marked, it leads to great deformity, and is recognized at a glance. It appears early, frequently in childhood, most often between ten and twenty, and rarely after the age of thirty. Women are a little more frequently affected than men. The first symptom is usually the slow development of a whitish or pigmented patch about the eye or on the cheek, chin, or forehead. The skin becomes thin and shiny and often brownish or yellowish, or a preliminary thickening may precede the atrophic change. Gradually the subcutaneous tissue shrinks, the part affected sinks in, and deformity becomes apparent. There may be only a small area at first affected, or the process may appear simultaneously in several patches, or, more rarely, the entire half of the face may share in the slow changes from the beginning. Sweating of the affected areas is usually decreased, and frequently the hair of the beard, eyelashes, and eyebrows turns white or falls out; the hairy scalp is very rarely affected. The muscles and bones are frequently involved, and as the frontal, nasal, malar, and jaw bones atrophy, the deformity becomes extreme. The muscles only slowly disappear, and may long maintain their function; reaction of degeneration has never been obtained (which speaks against the neuritic origin of the process).

The muscles of the tongue frequently share in the process; the atrophy is unilateral and on the same side as the face; there is neither fibrillary twitching nor reaction of degeneration. Schlesinger and Koerner described involvement of the larynx. The atrophy may be completely unilateral, or may remain confined to one area, as to the distribution of the first division of the trigeminus (Guilland) or to that of the second (Baerwinkel). In other cases the process may attack the other side of the face (Oppenheim, Wolf), or the arm and leg on the same side or the whole half of the body on the same or opposite side. Raynaud and Sicard reported the cases of a man of thirty and his sister of thirty-five with progressive atrophy of one side of the body from below upward; the leg, thigh, abdomen, thorax, arm, shoulder, and half the face were successively involved.

The affection may be preceded by paresthesia, or by neuralgic pains, and even by severe and long-continued trigeminal neuralgia (Hofmann, Olivier), muscle-twitching, hyperidrosis, or vasomotor disturbances. Oppenheim found anesthesia in the greater part of the affected side of the face in two cases, but, as a rule, there are no objective sensory changes. There are frequent complications with other nervous affections—with migraine, hysteria, epilepsy, tabes, syringomyelia, multiple sclerosis. Tachycardia has been noted in several cases. The association with scleroderma is frequent, and many writers share the view of Jonathan Hutchinson that hemiatrophy facialis is but a variety of circumscribed scleroderma (morphea) limited to the distribution of the trigeminus. Unna demonstrated the identity of the pathologic changes in the two affections, and Eulenberg emphasized the clinical relations—induration and atrophy of the skin and subcutaneous tissues, vasomotor disturbances, pigmentation, alopecia, and absence of marked sensory and motor symptoms. Two classes of cases have been reported—diffuse scleroderma plus facial hemiatrophy, and facial hemiatrophy plus a few patches of scleroderma. Steven and Lunz described hemiatrophy of the face and body associated with scleroderma. Gibney described a case of facial hemiatrophy with alopecia areata and scleroderma in the territory of one sciatic nerve, and Oppenheim one of typical facial hemiatrophy with atrophic changes in the skin and bones over the back.

The etiology of the affection is uncertain. Occasionally it has developed after wounds of the face, extraction of teeth, or removal of adenoids, but these factors are of such every-day occurrence that a direct association is hardly to be imagined. Severe trigeminal neuralgia has preceded in several instances, but whether of causal influence or an associated condition is not to be determined. Möbius, in his monograph, laid much stress upon the influence of local trauma and infection,—skin wounds, infections from teeth and tonsils,—and would explain the unilateral distribution by inherent differences of the body halves. But, as Cassirer remarks, this is a forced explanation of the unilateral distribution, and Oppenheim rightly observes that the theory would further have to assume that the peculiar infection gives rise to the disease only in those of neuropathic constitution. In the case of Virchow and Mendel there was microscopically a proliferating interstitial neuritis of the trigeminus, and the facial nerve was normal; most of the fibers of the trigeminus were, however, normal. Loebl and Wiesel reported the case of a woman of thirty-six in whom microscopically atrophy of the trigeminal muscles and degenerative changes from the Gasserian ganglion to the periphery were noted in the trigeminus. Brissaud assumes an affection of the spinal metamere of the trigeminus. Gegenbauer has shown that the trigeminus represents the sensory part of the first complete cranial metamere. Oppenheim advances several reasons why the sympathetic theory should receive weight. Somewhat similar atrophy of the face has been observed in sympathetic lesions (Jaquet, Bouveyron, Bavrel). Minor noted hemiatrophy after an operation on glands of the neck. In a remarkable case of Raynaud's disease described by Weiss there occurred palsy of the left sympathetic, followed by atrophy of the soft parts of the face lasting fourteen days. In an interesting case recorded by Oppenheim marked hemiatrophy of the face in a boy was accompanied by tenderness of the corresponding sympathetic. An enlarged gland near the superior ganglion was removed, and, though there was no connection with the sympathetic, considerable improvement occurred in five or six weeks. The improvement may have been due to a bettered general condition, and did not progress beyond a certain degree. Chipault tried resection of the sympathetic without result. The weight of opinion still favors a trophoneurotic origin of the affection.

Related to hemiatrophy is the opposite condition, hemihypertrophy, the pathogenesis of which is equally in dispute. A review of cases has been given by Mackay.*

The course of facial hemiatrophy is usually steadily progressive, but not necessarily so; the process may be confined to one part of the face or to one division of the fifth, and may not go on to complete atrophy. There is never any danger to life, and, as a rule, little disturbance from the affection beyond the marked deformity which it occasions.

There is not much to be expected from treatment. The same measures employed in the treatment of scleroderma should be given a trial. The deformity may be remedied somewhat by a plate fastened to the teeth which will restore the outline of the cheek. Injection of paraffin has been tried, and some successful cosmetic results have been reported. The dangers of embolism should be borne in mind and only paraffin of high melting-point employed.

HYPERTROPHIC PULMONARY OSTEOARTHROPATHY

Bamberger† first called attention to enlargement of the hands and feet and of the bones of the arms and legs in the course of certain heart and lung disorders. The condition was described in more detail in 1890 by Pierre Marie, and still bears the name proposed by him, *ostéo-arthropathie hypertrophiante pneumonique*. The most characteristic changes are seen in the terminal phalanges, which are clubbed and tipped by greatly thickened, curved, and deformed nails. The common terms, drumstick fingers, parrot-beak nails, well describe the appearances. The thickening of the lower end of the radius, ulna, or tibia may be marked, and at times is decidedly painful. Kyphosis has rarely been observed, and changes in the bones of the face do not occur. The enlargement of the hands differs from that in akromegaly by the predominant involvement of the phalanges, the deformity of the nails, and the changes in bony structure rather than in soft parts. Occasionally, however, transitional cases have been observed; Arnold, Teleky, and Schittenhelm have noted enlargement of soft parts, and rarefaction of the end phalanges has been described by Stoeltzing. Oppenheim, Decloux, Lippman, and Lemercier have reported a congenital form of the affection.

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* Brain, 1904, vol. xxvii, p. 388.

† Wien. klin. Woch., 1889, No. 11, p. 226; Zeit. f. klin. Med., Bd. xviii, pp. 193–217.

Men are more frequently affected than women. From the statistics of Thayer, based on fifty-five cases, the condition followed pulmonary affections forty-three times, syphilis and heart disease each three times, chronic diarrhea twice, spinal caries once, and in three cases the causes were not known. Putrid bronchitis, empyema, bronchiectasis, and chronic tuberculosis are the most common causes. Lemercier would separate pulmonary, cardiac, hepatic, and diathetic forms. The condition has been observed in chronic dysentery, pyelitis, ulcerating malignant growths, and several times in syphilis. The hepatogenous origin has been emphasized by Gilbert, Fournier, Parmentier, and Castaigne. Möbius described a case in which there was neuritis of one ulnar nerve, and the hypertrophic changes were much more marked in the fourth and fifth fingers on the affected side. A neuritic origin has also been noted by Hirschfeld and Berent.

The essential bone changes were described by Lefebre in 1891, who noted increased thickening in the outer layers, with rarefaction in the inner and marked activity of the medullary elements. The affected bones were rich in magnesium and fat. Extensive study has been made in the last years with *x*-ray plates, without, however, adding anything essentially new. The somewhat modified hypothesis of Marie is still the most generally accepted—that toxins absorbed from the lung, liver, suppurating growths, or the like act as irritants to the periosteum, and cause proliferation and ossification.

The development of the affection is in nearly all cases extremely slow, but, especially in empyema, marked thickening of the phalanges, nails, and lower ends of the arm and leg bones has been known to occur in a few weeks. Mousson noted a rapid development during empyema and complete disappearance of the process after evacuation of the pus. There is no direct treatment of the condition. Empyema should receive proper surgical treatment, and operations on putrid bronchitis or bronchiectasis may be attempted. If there is no obvious pulmonary, cardiac, or hepatic cause, the possibility of a syphilitic origin must be borne in mind, and thorough specific treatment inaugurated.

HYDROPS ARTICULORUM INTERMITTENS

This affection is characterized by a swelling of one or more joints, occurring at regular or irregular intervals, lasting usually a few days, and, as a rule, not accompanied by redness or fever. The swelling may be large, and is at times marked by pain, which may be severe. One chief peculiarity is that the knee on one or both sides is affected in nearly all cases (in 94 per cent., Schlesinger), although other joints may also be involved. The recurrent attacks may be exactly periodic over long periods, or may be utterly irregular, and without any determining cause. Schlesinger divides the affection into—(1) symptomatic and (2) idiopathic hydrops.*

In a case of Garré intermittent swelling of the ankle was associated with redness and temperature, and chiseling into the malleolus internus showed a central abscess. The writer has seen a similar case recurring over six years, but without temperature. The redness and pain of the foot resembled erythromelalgia, there was swelling into and about the joint, and the whole condition frequently entirely disappeared. *x*-Ray examination showed an abscess in the lower end of the tibia, which may have been of typhoidal origin; cure resulted from an operation. Albert saw intermittent swelling of the knee during gonorrhea, and recurrence of the effusion with exacerbation of the infection. Féré saw swelling of many joints recur every third week in a general paralytic until finally arthropathies developed. The writer has under observation a tabetic in whom one knee swells intermittently, sometimes after slight injury, and at other times without apparent cause. Féré observed hydrops intermittens associated with hysterical edema, and, in another instance, saw it develop in a case of morphinism each time that an attempt was made to withdraw the drug, and disappear promptly when morphin was given. The occurrence of intermittent joint swellings has been noted in exophthalmic goiter (Pletzer, Homén), in epilepsy (Féré), and frequently in hysteria. Weiss observed a case of Raynaud's disease with frequent swelling of finger, knee, and other joints, and Southey one with recurrent effusion into the knee-joints. According to Schlesinger, malaria as an etiologic factor has been much overrated, and periodicity is no sign of the malarial origin.

In the idiopathic form the association with nervous affections or with symptoms of vasomotor instability is strongly emphasized by Schlesinger. Moore, who first described the condition, noted tachycardia with onset of the effusion. Vertigo, pains in the muscles or actual cramp, flushing, and nausea have been noted as prodromes. Polyuria or pollakiuria may usher in or accompany an attack.

The swollen joints may be painless or the seat of severe pain. If there is accompanying redness, the condition may be most misleading, and surgeons have opened frequently such joints with the idea of finding infection. Bloodgood records some interesting cases of angioneurotic erythema, in one instance associated with joint swelling.* x-Ray examination and cytodiagnosis are of service in distinguishing from chronic inflammatory joints. From x-ray examinations, slight changes in joints have come to be much more appreciated in the last years, and it may be in future that the symptomatic group of swellings will grow at the expense of the idiopathic.

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* Mit. aus den Grenzgebieten der Medizin und Chirurgie, 1900, Bd. v, 441.

To Schlesinger belongs the credit of emphasizing strongly the close relations of angioneurotic edema and intermittent hydrops articulorum. He would include under the generic term of *hydrops hypostrophos* the entire group of affections characterized by intermittent occurrence of swellings in the skin or internal organs. Reports of skin edema in the course of intermittent hydrops articulorum are not infrequent (Féré, Senator, Homén, Rosenbach), and joint swellings have been noted in angioneurotic edema. The writer has seen, in a nervous woman, swellings in the skin and mucous membrane in the mouth, in both knees and ankles, and in the Achilles tendon-sheaths. Another woman seen three years ago had multiple recurrent skin swellings with swelling of both wrist-joints. The close correspondence of symptoms and the similarity of associations make it probable that the affection, like angioneurotic edema, is to be referred to a disturbance of the nervous influences that preside over vascular control.

In Schlesinger's statistics in 13 cases of symptomatic hydrops, the joints affected are as follows: One knee, eight times; both knees, three times; one knee and other joints, once; a joint other than the knee, once. In 35 cases of idiopathic hydrops the joints affected were: One knee twelve, both knees fifteen, times; the knee and other joints seven times; other joints alone twice. The affection is about equally divided between the sexes. Schlesinger lays stress upon the influence of physiologic and pathologic sexual phenomena in the determination of attacks.

The course and outlook are as uncertain as in cases of angioneurotic edema. The affection may seem of little moment to the patient, or the attacks may be so frequent as seriously to interfere with his activity or usefulness. Remarkable periodicity may later give way to infrequent attacks at intervals of months or even years. The swelling disappears spontaneously, and reappears often without cause; it is, therefore; difficult or even impossible to judge of the efficacy of therapeutic methods.

Naturally if the affection be but part of a tabes, or of malaria, or of an infection, appropriate treatment will be directed to the underlying condition. There is no certain method of relief that will apply to idiopathic cases; the swellings may disappear under the most varied measures, or persist despite them, or be made worse by them and spontaneously vanish if let alone. Arsenic and quinin have seemed the most serviceable drugs. Electricity, cold applications or douching, and immobilization may be grateful to the patient. It may be necessary to relieve pain by aspirin, phenacetin, or antipyrin. In a case of Schlesinger pyramidon was of great value when other remedies had failed. In a case seen by the writer, high-frequency currents seemed of some influence.

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* Johns Hopkins Hosp. Bull., vol. xiv, 1903, p. 138.

Rosenbach reported benefit from injections of ergotin about the affected joints; Villard and Rejan praised injections of tincture of iodin into the joints. The injection of adrenalin, 1 : 5000 or 1 : 10,000, into the joints might be tried, in view of its action in preventing accumulation of pleural effusions and ascites.

In a few cases of puncture or arthrotomy, the effusion returned or other joints promptly became involved (Koester, Eschricht, Bloodgood). Schlesinger would limit surgical interference to the cases in which the effusion had always attacked but one joint, and where all other measures had been tried in vain. Then injections might be tried, but the patient should be warned of the very problematic result.

LEONTIASIS OSSEA

The remarkable condition of multiple hyperostoses affecting the cranial bones is readily distinguished from leontiasis græcorum. Excellent clinical reports have been made by J. J. Putnam and Allen Starr, and more recently by Morton Prince. The last-named author dwells upon the close relationship of the affection with Paget's disease, and describes a case reported by Edes in 1896 as one of leontiasis ossea which has since developed the typical changes of osteitis deformans. The head has become generally enlarged, and the long bones characteristically affected. Hypertrophy of the malar bones has been supposed to be characteristic of hyperostosis cranii, but this has not always occurred, and Mennier, Gilles de la Tourette, and Magdalaine have described the condition with typical cases of Paget's disease. Bowlby and Edmunds, on the other hand, have described Paget's disease with involvement of but one long bone, and Hutchinson reported a case with but two bones affected. Allen Starr reported a case of leontiasis ossea with enlargement of the soft parts of the face and neck as well as of the cranial bones. Hutchinson and Thompson reported two cases of unilateral hypertrophy of the face with multiple hyperostoses in the same region. Instances of multiple cranial hyperostoses have been noted in syringomyelia (Collier, Westphal, Colman, Schlesinger). The association of leontiasis ossea with giantism is not unusual, as in the well-known case of the giant Wilkins, described recently by Busove.

From the above it becomes evident that the pathogenesis of the affection is still a closed chapter. The association with hemihypertrophy of the face and with syringomyelia would speak for a central trophic origin. Putnam regards trauma as of influence in etiology, and states that the affection begins in early life, as opposed to Paget's disease. The bony growths may start from the outer or the inner tables of the skull, and give rise to varied pressure symptoms—exophthalmos, neuralgias, symptoms of brain tumor. In a case seen by the writer there was enlargement of frontal and malar bones on one side, exophthalmos from an orbital growth on the other side, and finally complete blindness from an extensive growth in the anterior fossæ. The patient, a woman, committed suicide in despair of relief from her helpless condition.

No treatment is known for the affection, as organic extracts, iodids, arsenic, and other drugs have been tried without result. Surgery may relieve pressure symptoms at times, but the process is progressive, as a rule.

OSTEITIS DEFORMANS (PAGET'S DISEASE)

A well-marked case of Paget's disease can be mistaken for nothing else, provided the condition has once been seen. The patient's attitude suggests Parkinson's disease, but the large head, bowed femurs and tibiæ, and the thick clavicles are absolutely characteristic features. The condition would seem commoner than text-book descriptions would suggest; Locke has seen many cases in Boston. French, Watson, G. B. Shattuck, Sonnenberg and Morton Prince, Fitz, and Menetrier have lately written of the affection. The writer has seen three cases during the last year in San Francisco.

The disease is one of middle and advanced age, and more men than women are affected. From the monograph of Packard, Steele, and Kirkbride the bones affected were as follows: Bones of the skull in 49 cases; both tibiæ in 47; the femur in 40; the spine in 31. The patient may be unaware of his malady or may notice it by reason of the gradual increase in size of the head, demanding a larger size hat, or because his height steadily decreases. The onset is usually extremely gradual, but may be subacute, as in a case reported by Fitz. When fully developed, the great skull contrasts strangely with the narrow face. The patients look much older than their years, and the expression is often dull and sorrowful. Arteriosclerosis may develop early and be most pronounced, the temporals standing out thick and tortuous. There is usually marked kyphosis, and ankylosis of vertebræ or other joints is not uncommon. The hips are wide, the femurs curved outward, and the tibiæ remarkably thick and curved. The development is eminently chronic, and may cover a period of ten or more years. In one patient recently seen the condition was noted over thirty years before.

The etiology of the disease is unknown. The anatomic changes described by Packard consist in combination of rarefying and productive osteitis. The ordinary relations of the medulla and compact substance are destroyed, and the bones become thickened and distorted. Fractures do not accompany deformity, as the new-formed bone is frequently uncalcified and elastic. Morton Prince asserts that calcification often does occur in the new-formed bone, and is demonstrated by chemical analyses which may show no deviation from the normal lime content (Paget), or an actual increase (Robin, Gilles de la Tourette, and Magdalaine). Elting, Wilson, and Fitz have lately described in detail the *x*-ray appearances of the bones in typical cases. The usual osteoarthritic lesions are frequently observed in the spine, and marked arteriosclerosis is almost a constant feature. Association with malignant tumors and with organic changes in the nervous system has been noted at autopsies.

French writers describe the relations of Paget's disease and congenital syphilis (Etienne, Menetrier). Analogies with akromegaly, osteomalacia, fragilitas ossium, and the trophic bone changes occasionally observed in syringomyelia and tabes have been emphasized.

There is no rational treatment of the affection. Various organic extracts have been tried without effect, and treatment is limited to the preservation of nutrition and control, if possible, of the arteriosclerotic changes.

MICROMELIA (ACHONDROPLASIA, CHONDRODYSTROPHIA FŒTALIS)

The earliest reports of this affection dealt chiefly with pathologic findings, and until the paper of Müller in 1860, it was usually classed as fetal or congenital rickets. Virchow described it as fetal cretinism. Müller denied the relationship with rickets, and showed that the underlying process was an affection of the proliferating cartilage cells of the epiphyses which interfered with proper bony growth. Most of the cases are born prematurely or die soon after birth. The appearance of the fetus is characteristic. The head is large and the extremities very short, thick, and often bent. The root of the nose is retracted, the jaw prominent, the soft parts of the face are thickened, and the tongue protrudes. The condition cannot be differentiated from congenital myxedema except by microscopic examination. Some individuals survive, and are easily to be recognized in later years by persistence of the skeletal peculiarities. During childhood some of the changes in soft parts persist, and the children look somewhat like cretins or like the thyroid type of infantilism; the skin changes, however, are not those of thyroid disease. The characteristic features are the large head, retraction of the nose, and extremely short legs and short arms. Achondroplasic adults show less tendency to obesity, are intelligent, and show the same characteristic disparity of large head and trunk with extremely short extremities. The average height is from 3 to 4 feet. The fingers and toes are short and divergent. Shortening is more marked in the humerus and femur than in the bones of arms or legs. A number of cases with contracted pelves have been reported by obstetricians.

The abnormalities in growth can readily be explained by the dystrophic conditions in the epiphyseal cartilage. Inhibition of the growth of the bones at the base of the skull produces the retraction of the nose and prognathus, and disturbance in growth of the long bones explains the shortness of the extremities. Other changes than those of the skeleton are inconstant, and the pathogenesis of the affection is still entirely obscure. Kassowitz, in a recent monograph, groups micromelia with mongolism and myxedema. Nathan, from a review of literature and eight personal cases, does not think the thyroid play as part in etiology.* "We must confess that the pathogenesis of this, as well as nearly all other diseases, is still unexplained."

Infants with the affection are weak, and will require the most careful feeding; after this period the individuals are as well as the average. There is no known method of treatment for the condition.

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* Am. Jour. Med. Sci., 1904, vol. cxxvii, p. 690.

THE MUSCLES

DISEASES OF THE MUSCLES

By H. C. Moffitt, M.D.

ACUTE AND CHRONIC MUSCULAR RHEUMATISM

The tendency of the last years has been more and more toward limiting the scope of rheumatic affections. It has become recognized that many joint processes depend upon osteoarthritic changes or infections not related to rheumatism, and that many muscle affections formerly, with all confidence, called rheumatic must be referred to neuritis or to myositis of infectious origin. Pain is the chief and may be the only symptom of muscular rheumatism. It may be of moderate intensity and described as a dull ache or soreness, or may be acute, boring, or like severe cramp. Movement, either active or passive, increases the pain, but it may persist even with complete rest of the part. Pressure on the affected muscle may relieve or may increase the distress. True paroxysms of pain, such as are characteristic of neuralgia, do not occur. In order to avoid the pain consequent upon stretching or moving the affected muscles, the patients often assume attitudes which are almost pathognomonic; thus torticollis is due to contracture of the lateral group of neck muscles, and the stiff, immobile lower back of the patient with lumbago is due to contraction of the lumbar muscles, chiefly the quadratus lumborum, longissimus dorsi, and sacrolumbalis. Actual contractures may develop in long-standing severe cases.

Various names have been given to the affection of different groups of muscles. Stiff neck and lumbago are the most frequent varieties, but the intercostal muscles (pleurodynia), in fact, any of the voluntary muscles, may be involved. Very characteristic is the tendency of pain to wander from one muscle group to another; this may occur in the course of acute, but is particularly remarkable in chronic, cases.

The onset may be absolutely sudden (especially in a case of lumbago, the *Hexenschuss* of the Germans or *tour des reins* of the French), and the patient may be unable to move or may fall to the ground, as in a case of recurrent lumbago under the writer's notice. Usually there will be vague pains through many muscles, or there may be general aching and malaise before severe pain becomes a feature. Most authors describe the affection as running a course without temperature, but Leube has noted moderate or slight fever in a third of observed cases (over 200). Chronic rheumatism may have origin in acute myalgia, or the onset may be so gradual that patients cannot remember the beginning of their wearisome pains. Suffering is usually less intense, and periods of comparative comfort vary with exacerbations of pain and stiffness. Combinations with chronic joint affections and with aching and tenderness of muscle insertions are most usual.

Despite its every-day occurrence, the nature of myalgia is uncertain. Men are more frequently attacked. The common causes are cold and overexertion, and attacks are particularly liable to follow exposure to cold drafts when the body is overheated. As a rule, it is rather the sudden cooling of part of the body than thorough wetting or chilling—many attacks come on during summer. Runge supposed that cold acted through its influence on the vasomotor nerves or directly on the finest skin vessels. Vogel thought that hyperemia of the neurilemma best explained the pain and contractures. Leube thinks that myalgia is most often the expression of a mild infection, and emphasizes the frequent occurrence of fever and the association with articular rheumatism and endocarditis. Senator is of the opinion that either transitory hyperemia or an affection of the intramuscular sensory nerves lies at the basis of the affection. French writers lay stress upon a rheumatic diathesis. The constant attacks in some individuals and the chronicity of the process in others certainly speak for a disposition or constitution which renders the muscles much more vulnerable to the action of cold or overexertion.

Lorenz would limit the term muscular rheumatism to include only cases due to exposure to cold and characterized clinically by pain and even contractures, but without objective signs or anatomic lesions. The transition to cases with slight infiltrations or the muscle indurations first described by Froriep is, however, one not limited by sharp boundary-lines. The anatomic changes described by Adler belong rather to myositis than to rheumatism.

Many different affections have been labeled with the convenient title of chronic muscular rheumatism. The muscular pains that occur so frequently in gouty patients, particularly in the morning, or the varied aches of chronic alcoholic individuals, must be remembered. Rosenbach emphasizes the frequency of muscular pains with, or as equivalents of, migraine, and Oppenheim and Lamao observed severe circumscribed pain in the trunk or extremities to occur in place of a migraine attack, and last a few hours or a day. Lead-poisoning, nephritis, diabetes, anemia, and neurasthenia may be marked by muscular pain and aching, and the myalgia following trauma or due to flat-foot, varicose veins of the extremities, arteriosclerosis, hemorrhoids is well known.

An acute attack of muscular rheumatism lasts usually a few days or, exceptionally, a week or two. Attacks recur frequently in some individuals, particularly those of the indefinite "rheumatic habit," and the condition may finally become chronic. Treatment avails much in the acute, but may do little more than mitigate the chronic condition.

Treatment should have in view the etiologic influences of cold and overexertion, particularly in individuals with tendency to repeated attacks. The clothing should be warm, but it is a mistake of many individuals to wrap themselves in flannel; clinic patients, in whom the affection is so common, are often overloaded with clothing. Linen-mesh underwear seems of advantage in persons who perspire profusely. Susceptible individuals must be cautioned against cooling off quickly after unusual exertion. In patients of gouty habit diet should be supervised; limitation of the quantity of food is usually more important than restriction in quality. In obese or plethoric individuals limitation of carbohydrates is particularly advisable, and strong meat soups or the cellular meats, such as liver, brains, sweetbreads, are best ruled out of the dietary. Alcohol and tea and coffee should be prohibited or given in small amount. Green vegetables are of great advantage, and fruits, as a rule, agree well. Some patients, however, will have muscular pains after eating rhubarb or strawberries, and such idiosyncrasies must be regarded. In patients with chronic rheumatism and with good hearts it is wise to encourage the drinking of pure spring-water or mild alkaline waters between meals. The intemperate use of water internally and externally should be strongly discouraged. Constipation and a sluggish liver seem of influence in favoring attacks in some individuals, especially in those of plethoric habit with tendency to hemorrhoids and other varicosities. Here the occasional use of calomel, or of a pill of blue mass and compound extract of colocynth, or the more continuous use, during a month or two of every year, of Carlsbad Sprudel or sodium phosphate, will be of distinct advantage. In view of the indefinite metabolic changes which may be at the base of the rheumatic constitution, endeavor should be made to encourage elimination of waste material, not only by the bowel and kidneys, but also by the skin. Occasional profuse sweating, massage, and exercise are of great value. The Turkish bath, hot-air cabinets, and electric-light baths are convenient modes of inducing sweating. Care must be taken after baths that patients take time properly to cool off and rest before exposing themselves; the popular treatment of acute lumbago by the Turkish bath is often followed by a worse attack due to exposure directly afterward.

Symptomatic treatment varies according as the process is acute or chronic. Many acute attacks get well in a few days, either spontaneously or with use of household remedies, such as flaxseed poultices, ironing with a hot iron, mustard or porous plasters, or rubbing with camphorated oil, chloroform liniment, or arnica. If the attack is severe, pain and disability or contractures demand relief. In acute lumbago acupuncture affords quick relief (Ringer, Osler). An interesting review on this method of treatment has been given by E. Okada.* A thin lumbar puncture needle may be employed and plunged into the muscles on either side to a depth of 5 or 6 cm., being left in place five minutes. Deep injections of nitroglycerin, atropin, or camphorated oil are also most efficacious. If pain is very severe, a hypodermic of morphin and atropin may be given. If the patient be persuaded to submit to the procedure, the application of the faradic current to the affected muscles in strength sufficient to induce strong contractions may cut short a severe attack. Vigorous massage and passive movements will accomplish the same result, and it is becoming more and more recognized that these methods of treatment rather than rest are of more value even in acute attacks. The Paquelin cautery or repeated small fly blisters or applications of aconite and chloroform or menthol may afford some relief, and the use of dry or moist heat is usually grateful. The writer has seen little effect from the external use of mesotan.

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* Centralblatt f. d. Grenzgebiete, Bd. vii, 1901, p. 401.

Continued pain may be relieved by antipyrin, phenacetin, pyramidon, salipyrin, or aspirin. The salicylates may be of service in acute cases, but should be administered with alkalies to avoid harmful action on the kidneys; they should be given only over short periods of time, and accomplish little in chronic cases. Small doses of arnica internally, or frequently repeated doses of fluidextract of rhus toxicodendron (Sinkler), seem to be of service in some instances. The drugs of most service in chronic rheumatism are the iodids, cod-liver oil, strychnin, and arsenic. Occasionally guaiac resin and sulphur have been praised.

The chief methods of relief in chronic rheumatism will be found in change of climate and the use of massage, electricity, and exercise; unfortunately, many patients will be unable to change to Egypt, Mexico, Arizona, or to Pasadena, Riverside, or other towns of southern California.

The mechanical methods of treatment have been entirely too much neglected by the medical profession, and in no other disease, perhaps, does the irregular practitioner achieve such results as in treatment of chronic rheumatism. Adler, Norstrom, and Rosenbach have lately emphasized the great value of properly given massage. To be effectual the treatment must be continued for months in severe cases. With massage should be combined proper passive and resistant exercises, and the Zander machines may be advantageously employed. The vibratory treatment seems a distinct addition to massage in many instances.

Electricity has been employed in many ways. Electric baths and galvanization are grateful to the patient, but are of less service than strong faradization, static or high-frequency currents. D'Arsonval, Berlioz, Rouviere, Tripet, Morton, and Tousey have reported decided benefit from high-frequency currents, and the writer has seen definite relief of pain. Individuals with low blood-pressure do not seem to be proper candidates for the treatment, as they often feel tired and depressed after it.

Baths are of secondary importance to the above methods of treatment. Debilitated patients are frequently made worse by excessive bathing. Hot sulphur and mud baths enjoy a well-deserved reputation, but their administration should be under medical supervision, and not, as at most American resorts, left to the enthusiasm of the attendants or the patient himself.

ACUTE POLYMYOSITIS (DERMATOMYOSITIS)

Potain in 1875 and Wagner in 1883 had recorded cases of acute general myositis, but it was not until 1887 that descriptions of Unverricht, Hepp, and Wagner—all published about the same time—brought the affection into general notice as a well-defined clinical entity. Unverricht published a second paper in 1891, and changed his name for the affection from polymyositis progressiva acuta to dermatomyositis, the term which is now most commonly employed to designate the disease. The description of Unverricht still serves as a basis of classification, and despite the protests of Fränkel, Kader, and others, most writers agree in separating dermatomyositis from the suppurative form. The onset of the affection may be sudden, acute, or subacute, and its duration weeks, months, or even years. A prodromal stage is marked by the usual symptoms of oncoming infection,—malaise, headache, vague aching and stiffness in the limbs,—and may last a few days or two or three weeks. With the occurrence of skin and muscle involvement fever has been noted in all cases except one of Unverricht, and enlargement of the spleen is a usual feature. Skin rashes may precede or accompany the characteristic muscle changes. There may be patchy erythema or erythema nodosum, urticaria or varying degrees of cellulitis; different parts of the body are affected progressively or in remittent attacks. Edema appears early, usually first about the eyelids, and, as muscles progressively become involved, the greater part of the body may be greatly swollen and deformed, although hands and feet are most often spared. The edema is firm and hard and does not pit on pressure.

With appearance of edema the muscle pains become much more severe, and the least movement or pressure may be torture. Almost all muscles may be progressively affected, or the disease may progress remittently or by distinct intermittent attacks. In many cases the diaphragm and the muscles of the larynx or pharynx become involved, and in rare instances the eye muscles or tongue. An affection of the cardiac muscle has been once described, but most authors agree in separating polymyositis hæmorrhagica (in which cardiac muscle involvement is frequent) from dermatomyositis. Muscle outlines can rarely be felt, owing to the edema, but there has been described a peculiar doughiness or hardness. Contractures may develop (Jacoby, Koester), or marked paresis may be observed (Hepp, Jacoby). In chronic cases atrophy may advance to a considerable degree, and Schultze, Oppenheim, and Cassirer think that permanent or progressive muscle atrophy may be a sequel. Of late years many cases have been reported in which only a few muscles have been involved (Oppenheim, Schlesinger).

Nervous symptoms are usually not much in evidence except in terminal stages, but there are cases in which the polymyositis is associated with polyneuritis; the writer has lately seen such a case. Bronchopneumonia (often an aspiration pneumonia) and nephritis are the most serious complications of the affection. Potain's case developed endocarditis. Forchheimer observed a very low specific gravity of the blood (1033) in his case.

The prognosis is always grave. In Lorenz's collection of fifteen cases death occurred in eleven; restoration to normal took all the way from twelve days to two years. Oppenheim takes a more hopeful view; in ten personal cases but two deaths occurred, and complete cure resulted in five cases. Cases with favorable results have been communicated by Forchheimer, Levy, Herz, and others, and, as Oppenheim observes, the number will increase as slighter grades of the malady become recognized. The outlook is better in circumscribed cases, and in those in which the muscles of respiration and deglutition are not involved. The commonest cause of death is from bronchopneumonia following aspiration of food or a consequence of weakness of respiratory muscles. Death from nephritis or myocardial weakness has been observed. The course in many of the cases finally restored has been a tedious and long one, interrupted by many recurrent attacks. Prognosis as to complete restoration of function is rendered dubious by the fact that permanent or progressive muscle atrophy may be established. Oppenheim has lately emphasized the relations of dermatomyositis and scleroderma, and believes that scleroderma may occasionally have origin in polymyositis.

At autopsy the muscles show marked degenerative and interstitial changes; the fibers are often separated by edema and masses of leukocytes. Haetzoldt and Bauer found staphylococci in one case in the muscles, and Georgiewsky and Koermoeczi also report bacterial findings.

The affection has been observed after acute articular rheumatism, measles, tonsillitis, influenza, and gonorrhea, and most writers subscribe to the infectious origin. The many analogies with trichinosis led Unverricht to the idea that the affection might be due to gregarinidæ, and Pfeiffer has noted the similarity in appearance of the muscles with those of horses and rabbits affected by the parasites. Careful search for the parasites has been made, but so far unsuccessfully. Eosinophilia, so characteristic of trichiniasis, has been reported absent in a few cases, and examination of muscle removed during life has been wholly negative. Cold and overexertion have been accused (Gowers, Loewenfeld). Oppenheim saw two cases develop after rigid Kneipp cures, and would assign some influence to the long-continued exposure to cold. Senator, Albu, and Pfeiffer would ascribe influence to food-poisoning and intestinal intoxication. Lorenz writes: "Die Ursache der Dermatomyositis ist noch vollständig dunkel; alles, was bisher in dieser Richtung bekannt wurde, sind negative Befunde oder Hypothesen."

With the lack of any definite views as to the cause or nature of the affection, there can be no specific therapy. Salicylates and quinin have been tried repeatedly without effect. Oppenheim has seen good results from energetic diaphoresis in the acute stage and from the use of electricity and massage later on. Forchheimer thought Credé ointment of influence in one case, and the writer saw improvement follow inunctions of Credé and chlorid of iron internally. In addition to diaphoresis, free catharsis and flushing the bowel with salt solution should be tried in the early stages. Priessnitz compresses may relieve pain and soreness, but in many cases morphin must be given. Great care must be taken, when the muscles of deglutition and respiration become involved, to avoid aspiration pneumonia, and heart stimulants must frequently be administered. During recovery massage, electricity, and strychnin hypodermically will be of greatest value.

TRUE MUSCULAR HYPERTROPHY

As a rule, when muscles are unduly large, the increase in volume is due to fat deposits or interstitial changes rather than to increased muscle growth. Some individuals seem naturally to have unusual muscular development, and constant use of certain muscle groups may lead to marked increase in size. It is often hard to judge clinically between true and false hypertrophy, and even examination of excised portions of muscle may lead to error, as contraction frequently causes an appearance of thickening of the individual fibers (Gowers, Spencer, Oppenheim and Siemerling, Schiefferdecker).

True hypertrophy is most frequently observed in the course of muscle dystrophy and Thomsen's disease. Bruck described general muscular overgrowth in an idiotic child. Bressler reported a case of Robert Graves in which hypertrophy of calf and thigh muscles followed pain and cramps due to hip disease. Berger reported two cases of hypertrophy of muscles of the left leg following thrombosis of the femoral vein and a case following wound of the thigh. Benedict reported several cases in which the shoulder muscles were chiefly involved, and noted frequent association of vasomotor symptoms. Kron and Fulda described hypertrophic changes in many muscles in their cases, and emphasized the similarity with muscular dystrophy cases except that the affection begins in adult life, involves the arms most frequently, and is rarely symmetric. Paget first described hypertrophy of muscles as a result of venous thrombosis, and cases have been observed by Eulenberg, Berger, Redlich, Goldscheider, and Lorenz. The condition has most often followed thrombosis of the femoral vein after typhoid or trauma. The enlargement may be considerable, the muscular power either above or below normal.

Hypertrophy of muscles as well as of bones and other tissues of a part of the body has frequently been observed in syringomyelia. The enlargement of an extremity has been noted in erythromelalgia, and hypertrophy of muscles is an accompaniment of the peculiar trophic condition characterized by hemihypertrophy facialis. Hans Curschman* has reported two cases of marked muscular hypertrophy following long-continued cramp in the lower extremity. Schultze reported two cases of paroxysmal cramp associated with muscle overgrowth.

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* "Ueber Muskelhypertrophien hyperkinetischen Ursprungs bei toxischen Polyneuritiden," Münch. med. Woch., 1905, No. 34, p. 1627.

The nature of the affection is apparent when associated with thrombosis, attacks of cramp, or neuritis. Treatment in these instances will aim at relief of the underlying condition. In some cases of hypertrophy developing in adults and without definite cause Benedict and Auerbach saw marked improvement from long-continued use of galvanism.

PROGRESSIVE MUSCULAR DYSTROPHIES

The classification of muscular atrophies has again of late been under discussion, and transition forms between spinal muscular atrophies and the group of muscle dystrophies have been described. Strümpell is inclined to believe that all forms of atrophy depend upon congenital weakness of the motor neuron in one or another of its parts. Déjérine and Thomas have lately described muscular atrophy of the type Aran-Duchenne, in which the nervous system was found absolutely intact, and cases of true spinal muscular atrophy have been reported with the lesions of the dystrophies in the affected muscles. Owing to the well-marked differences in typical cases, however, it is well to preserve the divisions of spinal and neural atrophies and muscular dystrophies.

Erb gathered together and classified under the heading of "dystrophia musculorum progressiva" many forms of muscular atrophy and hypertrophy that had been regarded hitherto as separate entities. Common to all the types is the development in childhood or early life of certain peculiarities in gait and station, the frequent combination of hypertrophy and pseudohypertrophy with atrophy, the failure of reaction of degeneration, and the frequent influence of heredity. Varied forms have been described, dependent upon variations in the groups of muscles affected, or the age of onset, or the presence or absence of hypertrophic changes. Erb separated two groups: (1) Cases occurring in childhood; (2) cases developing in youth and young adults.

(*a*) The infantile form (Duchenne, Landouzy and Déjérine) is distinguished by the early involvement of facial muscles—the facio-scapulohumeral type of the last-named authors. It appears in early childhood, as a rule.

(*b*) The hereditary form (including the Leyden-Möbius and Zimmerlin types) begins in childhood. The lumbar muscles and lower extremities are first affected.

(*c*) The juvenile type begins later—about puberty or in young adults. The upper arm and shoulder girdle are usually first affected, and hypertrophy is limited to single muscles.

(*d*) The pseudohypertrophic form involves the back, pelvic, thigh, and calf muscles, and is characterized by diffuse hypertrophy and pseudohypertrophy. Muscles of the shoulder girdle and arms are more apt to show atrophic changes. The characteristic gait, station, and method of rising from the recumbent position are all most apparent.

The symptoms appear in earliest childhood; male children are most frequently attacked.

The affection is primarily a muscle disease, and the changes occasionally described in peripheral nerves and cord are probably secondary. Atrophic and hypertrophic changes are found side by side. There may be true hypertrophy of the primitive fibers, increase of muscle nuclei, and marked deposits of fat; enlargement of the muscles may depend on true hypertrophy or upon the excess of fat. In late stages entire muscles may wholly disappear. Contractures may occur, but are not frequent.

The affection is an excellent example of what Gowers has called abiotrophy. No causal factors are known other than the influences of heredity. The disease may occur through several generations, or there may be several cases in one family without any in the ascendants. Males are most frequently affected, but the disease is usually transmitted through the mother. Occasionally trauma or overexertion has seemed to precipitate the onset. Association with functional nervous affections and with congenital anomalies is not infrequent.

There is no direct danger from the affection except with serious involvement of the respiratory muscles. The prognosis of the juvenile type is better than of the forms which begin earlier. The process may advance very slowly or may even cease to advance; in most cases there is a gradual progression. With advanced atrophy, the patients are absolutely helpless, confined to bed, and death occurs from some intercurrent affection.

Therapeutic measures are necessarily of limited value. Overexertion must be guarded against, but all authorities agree that friction of the muscles, massage, passive movements, and moderate exercise are of distinct advantage. Gowers emphasizes the influence of properly directed exercise in retarding the progress of the affection. In a few cases long-continued treatment with mild galvanic currents has seemed of advantage. Drug treatment is of no avail. Phosphorus, arsenic, and strychnin have been recommended. Thyroid extract, thymus, and muscle juice have been given without result.

In case of troublesome contractures tenotomy may be done with benefit.

Members of muscle dystrophy families should be persuaded not to marry.

MYOTONIA (THOMSEN'S DISEASE)

This affection is classed under the myopathies, and is characterized by the occurrence of tonic spasm of the muscles on voluntary movement. Like the muscle dystrophies, it frequently occurs in several members of a family, and may be transmitted through several generations; over twenty cases in his own family through four generations were described by the Swedish physician, Thomsen.

Symptoms appear most often in early childhood, but may be overlooked until trauma or some accidental occurrences call attention to the muscular system. A surprising number of cases have been described in young recruits, as the individuals are unable to execute orders promptly. The disability is more marked when a sudden strong movement is intended. The muscles contract slowly and relax slowly. The cramp may last a few seconds or half a minute. Movements are begun with difficulty, but after a few contractions may be executed with normal quickness. Under emotional influences or cold, or after long periods of rest, the difficulty increases. As a rule, the entire muscular system is more or less affected, but with predominance of symptoms in legs and arms. The affection may be even limited to a few muscles—as those of the face or hand.

Very frequently the entire muscular system is overdeveloped, and the individuals look like gymnasium athletes. The strength is, however, rather below than above normal. Single muscles may be hypertrophied and the picture of muscle dystrophy closely imitated. Hoffman, Rossolimo, Schott, and others have dwelt on the association of atrophy and Thomsen's disease, and think progressive muscular atrophy may develop in the course of the affection. Erb described certain peculiar muscle phenomena and electric reactions. Mechanical muscle irritability is much increased, and the irritated muscle remains several seconds in contraction. The direct faradic irritability of the muscles is increased, with persistence of contraction. To galvanism the muscles react with slow tonic contractions that relax slowly, and, with application of an electrode on the back of the neck or sternum and the other in the hand and the use of strong currents (15 to 20 ma.), a peculiar undulation may be seen traveling through the muscles from the cathode to the anode.

In addition to typical cases, mostly of congenital origin, instances may be observed in which the peculiarity shows only in a few muscles, or in which the condition is but transitory. Jacoby would separate cases into three groups—congenital, acquired, and transitory. Talma has described a number of cases of the acquired form. Nothnagel saw muscle cramp of this character develop in the arm of a typhoid convalescent. Schlesinger has observed myotonic symptoms in certain muscle groups in syringomyelia. Frankl-Hochwart, Schultze, Hoffman, and others have described myotonia in the course of tetany. Eulenberg has described, under the name of "paramyotonia congenita," a peculiar stiffness of the muscles occurring under the influence of cold. Lundborg has written of the occurrence of myotonia in the family form of myoclonia. Edsall has lately described two cases of marked "transitory myokymia and myotonia apparently due to excessive hot weather," and has emphasized the present haphazard method of classifying myospasms.

Pathologic anatomic investigations point to a primary muscle affection. An exhaustive examination of the nervous system by Déjérine and Sottas failed to show appreciable lesions. Erb demonstrated hypertrophy of the muscular fibrillæ. Shiefferdecker and Schultze * describe moderate hypertrophy of the primitive fibers.

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* Deut. Zeit. f. Nervenheilkunde, 1903, Bd. xxv, p. 1, 345.

associated with atrophic fibers; proliferation of nuclei is no more than the increased size of fibers would account for; peculiar granulation of the sarcoplasm was noted.

Beyond the fact that the disease is a family and hereditary one, nothing is known of the causal factors. The influences of trauma and cold are but indirect; autointoxication and internal secretion (parathyroid) theories have not been substantiated; relationship of the parents has been accused—the parents of two girls with the affection observed by the writer are first cousins. Gowers is inclined to believe that nerve as well as muscle overaction plays a rôle in the affection, or that the nerve-cell overaction may be primary and the muscle cramp but secondary.

There is hardly ever any danger from the affection, but it persists through life and may handicap the patient considerably in his vocation. In rare cases sudden general cramp may throw the patient from his feet and lead to injury. There is no treatment of distinct value; Thomsen recommended active muscular exertion. The prognosis is rendered somewhat more gloomy by the possibility of later muscle atrophies and the rather frequent association of a certain degree of mental impairment.

PARAMYOCLONUS MULTIPLEX

This affection, described by Friedreich in 1881, is characterized by clonic contractions occurring chiefly in the extremities and trunk. The contractions are quick, occurring continuously, or in series of distinct attacks. Movement of the parts may be slight, owing to antagonistic muscles being involved synchronously. Unverricht described a type of the disease distinguished by its association with epilepsy and the occurrence in members of the same family, and Weiss, Gucci, and Lundborg have noted its inheritance through several generations. Lundborg lays stress upon dementia as a common outcome, and speaks of "dementia myoclonica."

There is great confusion in the classification of tics and myoclonias, many writers describing chronic chorea, convulsive tics, myokymia, and hysterical motor phenomena under the heading myoclonus. The name should be reserved for the symptom-complex described by Friedreich, regarding the form of Unverricht as a special type.

The affection is more common in young men, and has been ascribed to the influences of fright, trauma, or varied infections. No anatomic changes have been found in the muscles or the nervous system. Friedreich and Unverricht adopted the hypothesis of an increased irritability of the ganglion-cells of the anterior horns. Dysthyroidea has been accused, or, more lately, Lundborg has thought of a disturbed function of the parathyroids as cause of the affection.

The prognosis is not good except in the hysterical form. The associations with epilepsy and dementia in the Unverricht type renders the outcome still more gloomy. Prolonged warm baths, moderate exercise, and galvanism may be beneficial. Arsenic, bromids, and chloral have been the drugs most often recommended. Favorable effects have been reported from administration of thyroid extract; Oppenheim, however, has seen no good results. Parathyroid feeding should be tried in view of recent experimental evidence. Suggestion and hypnotism may be employed.

MYOSITIS OSSIFICANS PROGRESSIVA

This affection is characterized by the occurrence of multiple inflammatory lesions in the muscles, with a tendency to recur in definite attacks and to end in ossification. It may seem nothing more at first than ordinary rheumatism or myositis, and bony changes may take months to develop. The back and neck muscles are most often involved, but gradually, in subsequent attacks, almost the entire muscular system may be invaded. The mimetic muscles, as a rule, escape, but the masseters and temporals are not spared. Involvement of the thorax muscles may seriously impede respiration and favor development of lung affections. The ossification foci are at first small, but spread gradually by fusion or involvement of fresh areas until large bony tumors may result, and the adjacent fibrous tissues or bones may be invaded. From clinical observation and *x*-ray examination it has been finally established that the ossification is definitely intramuscular and does not represent invasion from adjacent bony structures.

The affection occurs at a very early age—sometimes in the first months, and nearly always before the age of twenty. Males are more often affected. The etiology is not known. Since Münchmeyer, most writers assume an inherited weakness of the muscular system with increased irritability and predisposition toward ossification. Trauma plays a great rôle in precipitating attacks, and even the slightest injury may be followed by appearance of new foci of disease in the affected part. The process is essentially a myositis ending in ossification, but the peculiar constitution favoring bony growth is wholly unexplained. The frequent occurrence (in 60 per cent. of cases) of microdactylia would add weight to the theory of a congenital tendency to the disease; the great toes on both sides are short and twisted inward; the thumbs may show similar deformity.

The disease progresses in recurrent attacks, between which, for weeks or months, the patients may seem perfectly well. Trauma is a frequent cause of renewed activity. The patients gradually become disabled, and deformities develop. Involvement of the masseters and temporals may seriously interfere with nutrition. Death occurs usually from some intercurrent affection.

There is no specific treatment. The patients must be guarded against injuries, even the most trifling. Surgical interference is, unfortunately, contraindicated except for imperative reasons, as the manipulations necessary for removal of bony tumors give rise to new irritation and formation of bony growths in the scar (Gibney). With serious locking of the jaws, however, operations must be attempted, and Braun, von Eiselsberg, and Pollard have reported permanent benefit.

DISEASES OF THE MIND

MENTAL DISEASES

By James Hendrie Lloyd, A.M., M.D.

Statement of the Subject.—Insanity may be defined as a disease of the brain in which there is derangement of the mental faculties. This definition, to be sure, is only provisional, for the time has not yet come to give an exact definition of insanity. Therefore it is desirable to point out, at once, the most important ways in which this term is to be delimited in an article devoted to the therapeutics of mental diseases.*

In the first place, it must be allowed that not all affections of the brain that cause derangement of the mental faculties are conventionally regarded as examples of insanity. The exceptions are not a few. Thus the delirium of fever, the concussion of the brain caused by violence, the acute poisoning by alcohol or morphin, the disturbance caused by a bad dream or by somnambulism—none of these is an example, conventionally speaking, of insanity, although they are all instances of affections of the brain in which there is derangement of the mental faculties. But even in these familiar examples the distinction from insanity is in a sense arbitrary, for most, if not all, of these affections are closely allied to, and may even terminate in, true insanity. From a therapeutic standpoint this fact is important. Thus, the delirium of fever, the intoxication from alcohol, and the disorders of the brain from trauma, may supply hints in the therapeutics of mental diseases, because infections, poisons, and injuries are potent causes of insanity.

In the second place, insanity in most instances is something more than an affection or derangement of the mental faculties. It may be in the widest sense a physical ailment, and one which involves many other organs than the brain. For instance, in the more violent or agitated forms of insanity, there is rapid exhaustion, even tending to death: in such cases all the vital functions of the body are involved. Digestion, nutrition, sleep, circulation, the blood-making function, the action of the skin, menstruation, and even the renal excretion, are all more or less perverted. The same is true in the worst forms of mental depression. Underlying the insanity, in fact, and probably in many cases acting as the true cause of it, is a disturbance of nutrition, which may even be a blood infection, or toxemia; and this is in every sense a physical disorder. It may be said, in fact, in some of these cases that the insanity is only an epiphenomenon, just as delirium may or may not be an incident in the course of a typhoid fever. From this standpoint it is evident that much light is thrown upon the therapeutics of insanity. This leads us to a brief statement of the etiology of mental diseases.

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* Much time has often been wasted in seeking for an exact definition of insanity. It is a mere dialectic feat—a sort of mental gymnastics—to indulge in this exercise; and the subject has but little practical usefulness. The question is more likely to loom up in medico-legal practice than in therapeutics. Winslow ("Plea of Insanity," p. 76) cautioned medical witnesses not to attempt to define insanity, and an eminent British jurist, Lord Justice Blackburn, said before a committee of the House of Commons, that he verily believed it was not in human power to do it. Among the most noteworthy definitions are those of Esquirol ("Mental Maladies," Am. Trans., p. 21), and of Brigham—the latter of which is not unlike that given in the text above, and is as follows: "Insanity is a chronic disease of the brain, producing either derangement of the intellectual faculties, or prolonged change of the feelings, affections, and habits." But insanity is not always a chronic disease. (See an article by Borie, in the "Edin. Med. Journ.," 1865, vol. xi, p. 21, on "The Definition of Insanity.")

THE CAUSES OF INSANITY

This subject is of signal importance for a proper understanding of therapeutics.* Among the most common causes are heredity, alcohol, narcotics, syphilis, infection, exhaustion, trauma, shock, emotional disturbance, and all other agents that pervert or interfere with the normal nutrition of the brain.

The exact relation of **heredity** to insanity is uncertain. Statistics vary, but the vast number of instances now observed leaves no doubt that this is an important factor.† Maudsley says that from one-fourth to one-half of the insane have the hereditary taint. Sankey says one-fifth, but this is far too low. From a report made to the French government in 1861 it appeared that 530 out of 1000 insane patients had a history of heredity. Exact figures are difficult to obtain because of the ignorance or reticence of the patients and their friends. Heredity may be shown either in the lineal or in collateral lines. It often acts by transformation: that is, the ancestral stock may show other nervous disorders, such as epilepsy, inebriety, hysteria, and neurasthenia. In such cases there is a neurotic taint, and insanity is evolved upon this soil.

Alcohol is a direct poison to the nervous system, and is an ever active cause of mental disease. It has been supposed to be a much more prevalent cause in modern than in ancient times because of the facility and cheapness with which distilled spirits are made and put upon the market in the present day. Morel‡ was one of the first to demonstrate that this modern curse is the cause of a chronic degeneration which shows itself not only in the immediate victims but also in their descendants through several generations. It causes both acute and chronic insanities; as delirium tremens, mania à potu, chronic systematized insanity, and general paresis; while it contributes to the causation of idiocy, imbecility, and epilepsy in the offspring.

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* Krafft-Ebing: "Lehrbuch der Psychiatrie"; also "Traité Clinique de Psychiatrie," traduit par Laurent, Deux. Part, Chap. Prim., p. 167.

† Lloyd: in Wharton and Stillé's "Med. Jurisp.," fifth ed., vol. iii, p. 591; Drähms: "The Criminal," p. 137; Hagen: "Statistische Untersuchungen über Geisteskrankheiten," 1876.

‡ Morel: "Traité des Dégénérescences," Paris, 1857.

Narcotics, such as opium and its derivatives, cocain, cannabis indica, and chloral, are not infrequent causes of insanity.

The action of **syphilis** upon the nervous system has been well understood since the researches of Heubner.* This poison acts primarily upon the coats of the blood-vessels, and spreads thence to the connective tissue and the neuroglia, causing often an exudate which involves the nervous tissue. The exciting agent of syphilis is now believed to be a spirochæte. It possibly causes a toxin, which may act directly upon the nerve-cells, as well as upon the blood-vessels and neuroglia. Thus syphilis is the cause of many and diversified symptoms in the nervous system, not all of them mental. But of these mental affections the commonest are syphilitic dementia and general paresis.

Infections of various kinds may cause mental disorder. Such psychoses as accompany the infectious fevers—the delirium, for instance, of typhoid fever, of typhus fever, of smallpox, of pneumonia, and of cerebrospinal fever—are instances unquestionably of the intoxicating action of microbes, or their toxins, on the brain. In some cases this mental disorder continues after the subsidence of the fever, and constitutes a veritable insanity, sometimes called post-febrile insanity. Septic conditions, such as occur in surgical cases and in child-bed, are also responsible for mental disease. Another cause is tuberculosis. Bacteriology, in fact, offers an immense field for investigation in mental pathology.† It is possible that we are only at the threshold of the subject as yet.

Trauma may contribute to the causation of insanity, especially when it is associated with profound mental shock, as in railroad accidents, in which great fright as well as physical injury is experienced. Delirium may result in such cases, as well as long-continued depression or confusion of mind; and in some instances a delusional mental state, such as paranoia, may occur. A noted case in medico-legal annals was that of Hadfield, who shot at George III. This man had received a severe injury to his brain in battle. He became insane, and was successfully defended by Erskine in a celebrated speech in the court of King's Bench.‡ Surgical operations sometimes act as traumata to cause insanity.

Closely allied with shock are **emotional disturbances** of all kinds, such as grief, fear, anxiety, disappointment, shame, and religious and political excitement.

Exhaustion, as from overwork, ill-feeding, bad hygiene, or in fact from any cause which seriously interferes with nutrition, is often a cause of a mental breakdown. So also may a sunstroke, or poisoning, as from lead or mercury, cause grave and long-continued insanity. Affections of the thyroid gland, as in myxedema and exophthalmic goiter, cause grave mental disorders. Imprisonment, especially solitary confinement; and military service, especially in the tropics, conduce to mental disease. The latter cause has been active among the American troops in the Philippine Islands.

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* Heubner: "Die luetische Erkrankungen der Hirnarterien," 1874; also Ziemssen's Cyclopedia, vol. xii.

† Berkley: "Mental Diseases," p. 361. This is the best work in the English language for the study of the infection psychoses.

‡ Howell's "State Trials," vol. xxvii, p. 1281.

In brief, any cause that leads to impaired nutrition of the brain, especially in neurotic persons, or those who are predisposed by heredity or by constitution, may cause insanity. And this leads to the general statement, so important from a therapeutic standpoint, that insanity is a disease of the organic brain, and is the evidence of impaired metabolism, superadded in some cases to a constitutional defect.

THE VARIOUS FORMS OF INSANITY

For our present purposes a very brief statement of the various forms of insanity is all that is required, and these may be presented without any attempt at elaborate classification. As the main object in this chapter is therapeutics, it is desirable merely to state the various psychoses with reference especially to the indications for treatment. All speculation and controversy will be avoided.

It has long been customary to distinguish between states of excitement and states of depression in mental disease. The former are included under the term "mania"; the latter under "melancholia."

Mania is defined as a functional mental disease in which there is a morbid acceleration of the ideas and increased irritability of the motor centers of the brain.* There is exaltation, tending to incoherence, with motor excitement, and the emotional state is one sometimes of gaiety, but sometimes of irritability and anxiety. The tendency is often to rapid exhaustion. There may be loss of flesh, impaired digestion, and insomnia. In severe cases there is confusion of ideas, great loquaciousness, constant restlessness, and the formation of delusional ideas. The conduct may become violent; the patient struggles, resists, and fights; he uses unseemly language, and may be destructive of clothing, furniture, etc. There is complete loss of self-control, with entire change of character, refusal of food, dirty habits, and noisy declamation. In short, there is general excitement of the brain.

Melancholia is often defined as the opposite of mania. Its characteristic is mental pain with profound depression. The melancholiac usually has delusions of personal unworthiness, of impending evil, and of physical ailments. In grave cases there may be hallucinations of sight and hearing. The mental suffering is intense, but the reasoning faculties are sometimes well preserved, the emotional disturbance being the conspicuous symptom. The conduct is in accord with this mental state: the patient is dull, dejected, apathetic. He reproaches himself, or he may be mute. The physical health sometimes suffers greatly; food is refused; nutrition falls off; the secretions are impaired, and sleep is disturbed or abolished. In some cases there is great agitation—*melancholia agitata*. In others there is complete apathy and the appearance of stupor—*melancholia attonita*. The great risk in melancholia is of suicide.

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* Mendel: "Die Manie."

Manic-depressive Insanity.—Very recently, under the leadership of Kraepelin,* a German alienist, it has become quite common in America to describe a manic-depressive insanity, in which the time-honored distinction between mania and melancholia is ignored. In some cases, it is true, both these mental states may be seen, either alternating, or following each other in cycles, or even coexisting in a sense in the same patient. This tendency, however, to break down the distinction between these two chief psychoses seems too radical to many clinicians, and it is not likely ultimately to prevail. The question is purely a nosologic one, and need not detain us here. It is enough to say that this so-called manic-depressive insanity is the clinical expression of a profoundly disturbed nutrition of the brain, and demands, like mania and melancholia, a plan of treatment directed to restore nutrition. In some of these double forms, however, especially in periodic and circular insanity, as described originally by Falret, heredity is marked; prognosis is bad; and treatment, so far as permanent cure is concerned, is likely to be unavailing.

Delirium.—Under this head are included what are known as the *infection psychoses*. In some mental cases there is a veritable delirium, rather than a mania. This delirium is not unlike the kindred mental state seen in the infectious fevers, such as typhoid fever, pneumonia, etc. There is great confusion, incoherence, loss of the sense of identity of persons and place, muttering, restlessness, jactitation, in grave cases proceeding to profound stupor and even coma. These severe cases are sometimes called *acute delirium*, or *delirium grave*. In milder cases they are called *confusional insanity*, when, as their name indicates, there is confusion of mind, often associated with hallucinations of sight and hearing. These delirious and confusional types are especially suggestive of a blood infection; and, in fact, as already said, they sometimes occur after the infectious diseases and in cases of sepsis. The insanity sometimes seen in puerperal cases is usually of this type. In pure cases of acute delirium, however, it is often impossible to demonstrate a microbian infection, although the general clinical appearances strongly suggest it.†

Toxic Insanities.—Of first importance from a therapeutic standpoint are the various toxic insanities, chief among which are those caused by alcohol. Since Magnus Huss wrote his work on chronic alcoholism,‡ this subject has been widely studied, for alcohol is fully recognized to-day as supplying one of the great problems of pathology.§ The mental diseases caused by alcohol are either acute or chronic. Of the former, delirium tremens is the common type; in this affection the delirium is not unlike that caused by the infectious fevers, but it is distinguished especially by muscular tremors, and by hallucinations, especially of sight. The physical disorder is also marked; there is impaired digestion and nutrition, refusal of food, insomnia, prostration, and in grave cases a typhoid state. In chronic alcoholic insanity there is, in addition to various physical derangements, especially of the liver, stomach, kidneys, and blood-vessels, a tendency to the formation of systematized delusions, such as of persecution and of marital infidelity, along with change of character, and characteristic mental and moral perversions. Alcoholism is also a potent factor in the causation of general paresis; in fact, some French writers attach more importance to it in this respect than to syphilis.

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* Kraepelin: "Psychiatrie," 1903. See also Paton's recent treatise, "Psychiatry," chap. xiii, 1905, for a reflex of Kraepelin's ideas.

† Stoddart (Lancet, March 5, 1904) has advanced a theory of infection, according to which in mania an irritating substance is formed within the brain-cells, while in melancholia a paralyzing substance is formed.

‡ Magnus Huss: "Alcoholismus Chronicus," Stockholm, 1851.

§ Bevan Lewis: "Mental Diseases," second ed., p. 345.

In the search for novelties, or for old things under new names, we hear much nowadays about Korsakoff's psychosis. This is a delirious state, sometimes called "chronic delirium tremens," in which there is great confusion of identity of persons, time, and place, with a tendency to "fabulation" and the formation of hallucinations of sight and hearing. It is seen especially in cases of alcoholic multiple neuritis.*

Opium and its various derivatives, when used habitually and to excess, cause mental and moral changes that are more or less characteristic.† The same may be said of cocain. In fact, cocain, as was first pointed out by Erlenmeyer,‡ causes a typical delusional insanity, in which hallucinations are common. Many drug habitués use more than one drug; thus cocain users, as a rule, are also addicted to morphin. These victims deteriorate rapidly, in both body and mind, and soon become wrecks. In the cocain habitué especially there are loss of weight, muscular weakness, tremor, anesthesia, and disturbance of the heart and circulation.§ Among other drugs may be mentioned chloral, ether, and chloroform, but their abuse is not common in this country.|| Ether has sometimes been substituted for alcohol, as in Ireland in 1842, after the crusade of Father Matthew against drunkenness.** Cannabis indica, or hashish, is greatly abused in the East, and is the prolific cause of insanity in Egypt and India.††

Syphilitic Insanity.—Syphilis is a potent cause of evil in the nervous system, as already explained. It causes many nervous symptoms

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* See Hurd: "Korsakoff's Psychosis," Am. Journ. Insanity, July, 1905, p. 63; also H. W. Miller: ibid., Jan., 1904, for bibliography; and Cole: "On Changes in the Central Nervous System in the Neurotic Disorders of Chronic Alcoholism," Brain, Autumn, 1902.

† Kerr: "Inebriety," third ed., New York, 1894.

‡ Erlenmeyer: "Ueber Cocainsucht," Deut. med. Ztg., 1886, vii, 483.

§ Lloyd, in Wharton and Stillé's "Med. Jurisp.," fifth ed., vol. i, p. 874.

|| Dante Gabriel Rossetti, the English poet and painter, had the chloral habit, and used to take 60 grains at a dose, repeated at frequent intervals. He became insane, with delusions of persecution. His wife was an opium taker, and died from an overdose, whether by accident or design was not certain. Wilkie Collins, the novelist, drank his laudanum by the wineglassful, and when remonstrated with by a friend, told him not to be alarmed, for De Quincey used to drink laudanum out of a jug. These instances are given by Hall Caine in "My Story."

** "Twentieth Cent. Practice," vol. iii, p. 96.

†† Peterson: "Medical Notes in Egypt."

by its action on the brain and spinal cord, and among these are various mental changes. Headache, insomnia, or its opposite, somnolence, confusion, stupor, dementia, and epileptiform seizures are the commonest symptoms; and in the aggregate, or in various combinations, they constitute the disease known as *syphilitic dementia*. This affection must be distinguished from general paresis, for while it has some features in common with the latter disease, and may possibly even merge into it, it is in some ways distinguishable. There is not the same classic evolution as in paresis, and, what is of the greatest importance, the simple dementia of syphilis is sometimes curable. This syphilitic dementia is probably due to a specific inflammation diffused over a large surface of the brain cortex.

General paresis is now one of the best known forms of insanity, and is dependent on a diffuse inflammatory or degenerative process in the brain. It is characterized by change of character, expansive delusions, progressive dementia, affections of gait and speech, and, in the advanced stages, by epileptiform and apoplectiform crises, with various forms of paralysis. Its tendency is steadily onward and downward, and it terminates quite uniformly in death. Syphilis is doubtless a most important factor in the causation of general paresis, but statistics vary as to the frequency of this cause. Savage* gives 70 per cent.; Berkley† 50 per cent.; while more recent observers claim that the disease is invariably syphilitic. These figures, however, supply little if any basis for treatment, because anti-syphilitic treatment will not cure general paresis.

Insanity is not uncommonly associated with the *great neuroses*, such as epilepsy, hysteria, and neurasthenia. The most important of these is unquestionably epilepsy, for there are many forms of epileptic insanity.‡ Of these, the most common are epileptic mania and fury, automatism, and concealed or masked epilepsy, in which there are substituted mental crises in the place of the fits. Some of these patients display great violence. In hysteria and neurasthenia there are also mental disorders, such as hysterical trance, somnambulism, and delirium; while in neurasthenia it is not uncommon to have various obsessions, such as the insanity of doubt, and various morbid fears or phobias, and morbid impulses.§ Many of these latter states are amenable to treatment. A delirium or confusional insanity is sometimes seen in chorea.

Senile insanity, or the insanity of old age, is now generally classed with the organic insanities, *i. e.*, those in which the mental changes are due to organic and visible changes in the structure of the brain. The commonest of these changes are atheroma of the blood-vessels, with atrophy of the convolutions, and thickening of the brain membranes.

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* Savage: "Allbutt's Syst. of Med.," vol. viii, p. 692.

† Berkley: "Mental Diseases," p. 175; see also Mott: "Arch. of Neurology," vol. i.

‡ Spratling: "Epilepsy and Its Treatment," 1904.

§ Legrand du Saulle: "La Folie du Doute," Paris, 1875; Raymond et Janet: "Les Obsessions et la Psychasthenia," 1903; Seglas: "Leçons Clinique sur les Maladies Mentals," Paris, 1895.

In old age we see various forms of mental deterioration, such as failure of memory, loss of interest, inability to apply the mind, lack of energy, a tendency to tire easily, a weakening of the judgment, and changes in the tastes and affections. This is the period also when apoplectic, epileptic, and hemiplegic accidents occur, due to the diseased blood-vessels.* Occasionally there are crises of mania or melancholia, and in advancing cases delusions are not uncommon. Senile insanity, in a word, is the expression of the degeneration of tissue, and this insanity sometimes progresses to complete dementia.† It is needless to say that this mental disorder is not easily, if at all, influenced by treatment.

Paranoia.—Engrafted upon a constitutional basis, and therefore in many but not all cases a distinctly hereditary form of insanity, is the disease known as paranoia. The older alienists called this disease monomania. It is characterized especially by systematized and fixed delusions, and these delusions dominate character and determine conduct. The delusions of paranoia are either persecutory or expansive; in fact, not unusually the disease follows a regular evolution, the persecutory delusions, or those of suspicion, appearing first, to be followed in time by the expansive type. In the persecutory stage the patient becomes suspicious and gradually harbors ideas that he is persecuted by enemies or unseen agencies; he thus becomes resentful and dangerous. The criminal insane are largely recruited from this class. In a later stage the patient undergoes a complete transformation of his personality; he forms expansive delusions, as that he is a personage of importance, a great statesman or prophet, an inventor, a king or even a messiah. There are many grades of paranoia, ranging from mere eccentricity and moral perversity all the way to the fully systematized types just referred to.‡

Dementia præcox is a disease occurring usually in early life and leading to rapid and often permanent deterioration of the mental faculties. The term was introduced by Pick in 1891. Kraepelin divides these cases into three types—hebephrenia, katatonia, and the paranoid form. In hebephrenia there is both melancholia and excitement, with confusion, weird delusions, hallucinations, and obsessions; also morbid impulses which may lead to the commission of violent acts. In katatonia there is a tendency to stuporous or melancholic states with cataleptoid symptoms. In the paranoid form delusions of persecution and exaltation, more or less systematized, are observed. Many fine distinctions are made by some systematic writers, but in all these forms, and especially in the first two, there is a marked tendency to dementia, which may be permanent. Still, the prognosis in some cases of juvenile insanity is not necessarily unfavorable. Some few of these patients recover, in spite of the gloomy opinion expressed of the class by good authorities.*

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* Spratling ("Epilepsy," p. 32) discusses senile epilepsy, or the epilepsy which comes on late in life, and is doubtless due to the degeneration in the brain-tissue, especially in the blood-vessels.

† Pickett: "Senile Dementia: A Clinical Study of Two Hundred Cases, with Particular Reference to Types of the Disease," Jour. Nerv. and Ment. Dis., Feb., 1904.

‡ Spitzka: "Insanity," 1887; Krafft-Ebing: "Lehrbuch"; also a French translation by Laurent. These two works give especially good descriptions of monomania or paranoia.

Pellagra is a toxemia due to certain poisonous agents which develop in maize improperly kept.† The symptoms are of gastro-intestinal irritation, certain skin-lesions, and affections of the cerebrospinal system. In chronic cases a stuporous melancholia occurs, with a tendency to suicide. There are probably more cases in American asylums than have been suspected, as the disease is only now beginning to be generally looked for and recognized in this country. The treatment is by elimination, good food, baths, iron, and arsenic, as these will be described presently.

Idiocy.—There remains to be mentioned briefly idiocy, to which is allied *imbecility*. From a very early period, both in law and in medicine, a distinction has been observed between insanity and idiocy.‡ By an idiot is meant a person who was either born with defective brain, or became so at a very early period in life before the brain was developed. These patients constitute a special class, requiring special treatment, training, and care, and they are not properly included for consideration in the present section.

THE THERAPEUTICS OF INSANITY

I shall discuss this subject under appropriate heads, pointing out under each head the indications for the treatment of the various symptoms and forms of insanity. As the first question that arises in every individual case refers to the selection of an appropriate place for conducting rteatment, I shall discuss first the home treatment; then isolation; then in due order the various means of treatment, such as drugs, hygiene, feeding, rest, hydrotherapeutics, restraint, amusements, and suggestion.

Home Treatment.—It might almost be laid down as an axiom that there should be no such thing as home treatment of the insane. It were better in every case of mental disease that the patient be removed from home. This does not necessarily mean that he should be hastily certified as a lunatic and hurried off to an asylum. Neither does it mean that an excited or a depressed patient should be started off on long and tiresome journeyings for "change of scene." It means that in every incipient or early case the patient should be taken to some quiet sanitarium, or to some private quarters, and there nursed and tended back to health. I shall say more of this presently.

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* Pickett (Jour. of Nerv. and Ment. Dis., Aug., 1901) gives a lucid discussion of the insanities of adolescence. The term "hebephrenia" was first proposed by Hecker in Virchow's Archiv, 52, p. 394. "Katatonia" was first described by Kahlbaum, Berlin, 1874.

† See *ante*, vol. i, p. 756, where this disease is described in detail.

‡ This distinction was made in English law as early as the reign of Edward II, A. D. 1342, in the statute known as *De Prerogativâ Regis*. See chapter on "Non Compos Mentis," by Lloyd, in Wharton and Stillé's "Med. Jurisprudence," fifth ed., vol. i, p. 482, for historical notes.

But, whatever our private judgment may be, there are cases occasionally in which the patient and his friends strenuously object to a removal from home; and, having the means, insist upon home treatment. The practitioner sometimes must needs recognize the fact, and accommodate himself to the circumstances. Some practitioners, however, decline to treat patients at home; this is a matter of individual judgment; but in any case in which such treatment is undertaken the practitioner should carefully state the objections to it, and insist that the patient's family and friends understand that they assume their full share of the responsibility for the results.

The objections to home treatment are numerous. They may be summed up in the expression, "bad morale." There is lack of discipline, lack of proper routine, lack of proper control by physicians and nurses, interference of relatives, and the tendency and opportunity for the sick person to tyrannize over his or her own household. Nothing can exceed the state of demoralization in which a household can be thrown by an insane patient. Relatives, friends, nurses, servants, even doctors, fall victims to this demoralization. Fortunately in most cases, after a trial is made, and much money expended to little purpose, the endurance and resources of the family are exhausted, and they are willing to listen to reason. Then, and not till then, the patient can be removed to a proper place for treatment.

The cases which are likely to demand home treatment at first are the simple acute cases, such as mild melancholia, or cases of confusional insanity and delirium in their early stages, such as puerperal insanity, post-febrile insanity, and some of the toxic insanities. The friends of the puerperal patient are especially averse to sending the young wife and mother to an asylum. This is a natural aversion, and one which should be respected, but with the opportunities which now offer in some places for treating these patients in private and special hospitals, without certification, there is no longer the same objection to removing them from home.*

The indications for treating a patient are practically the same whether at home or in a hospital, and these indications are to be described in the following pages:

Isolation.—By isolation is meant the removal of the patient from home and the placing of him or her in some appropriate retreat for care and treatment. This isolation can be secured in an asylum, or in a special hospital, or in a private sanitarium, or in a general hospital, or in a private residence.†

The asylums of this country are in the main admirable institutions—among the best in the world. I have little sympathy with the tendency now manifest in some quarters to decry our American asylums for the insane, and to insinuate that they are behind the times—more especially because they are not patterned after those of

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* Chapin: "Compendium of Insanity," p. 81.

† Camus et Pagniez: "Isolement et Psychotherapie," Paris, 1904. These authors look upon isolation as an important factor in suggestive therapeutics. They even carry it to the extent of hanging a curtain around the patient's bed.

Germany. I believe that they are doing a most important and essential work, many of them in the best possible way, and if all are not equally good, this is not the place to expatiate on their defects. A large majority of the insane require detention and treatment in an asylum, and the sooner they are sent to one the better. This section will be limited to a brief statement of the advantages of asylum treatment for certain classes of the insane.

An asylum or hospital for the insane has the advantage of having a regular discipline and routine. It is conducted by trained experts, who devote all their time to the work, and who are constantly on hand, and in contact with their patients. Such an institution therefore offers the best possible means for personal supervision, and for the minute care of patients in all the details of the daily life. Moreover, it offers the best means of safeguarding the patient, and of protecting himself and society from the effects of his disease.

There are certain essentials which every good asylum should possess, and which most of our American asylums do possess. Among these essentials are large and attractive grounds, laid out in lawns, parks, and gardens. These grounds supply the need for plenty of outdoor life, and this life can be led by the patient with both security and privacy. There are asylums in this country which are unsurpassed by any in the world for the beauty and extent of their grounds; in fact, special attention is paid in America to making the landscape gardening a feature of the institution. The mental effect upon some patients is not insignificant, and the advantage to all patients, even to those who require indoor treatment for a part of the time, is not slight.

A well-regulated asylum should have all the clinical and laboratory facilities of a good general hospital, and it goes without saying that it should have a staff of attendants who are trained in the use of such facilities. In this respect some of our hospitals for the insane in America are not so well equipped as they should be. An asylum is not meant merely as a place of detention, although this function can never be ignored, especially with respect to the chronic insane. Such an asylum is also a place for treatment, as well as for careful and expert clinical study, and this clinical study should include all the organs of the body, for the insane, as a rule, are not sick merely in their minds. Careful and complete supervision of the physical state of every patient should be insisted on, and a complete system of note-taking should be adopted and carried out. This we owe not only to our individual patients, but also to the science of psychiatry. It is only fair to say that great advances have been made in America in this respect in recent years, and a wholesome recognition of the demand for exact scientific and clinical work is now more and more apparent.*

Special hospitals for the chronic insane have been established in some of our states. These furnish special facilities for the employment of this unfortunate class, especially for work in the open air. Such hospitals usually have farm lands, by which a regular and wholesome employment is secured, and they also train the patients in some of the mechanic arts, such as manufacturing various articles, as clothing, furniture, etc. One of the best of these institutions is at Wernersville in Pennsylvania. At this hospital hundreds of chronic lunatics, who would otherwise be merely vegetating in the State hospitals, are brought together, thus relieving the regular asylums; and they are thus enabled to lead a more nearly normal life than they could elsewhere.

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* Mitchell, S. Weir: Address before the Am. Med. Psychol. Assn., at Philadelphia, 1894 (Trans. of the Association).

This problem of separating the chronic from the acute insane, and treating the two classes apart, is an urgent one everywhere. Brush says that the average population of our State asylums contains not more than 10 per cent. of recoverable patients.* It is not proper that no distinction should be made between the two classes, and all be herded together. The suggestion has been made that these large asylums should each have its own smaller special hospital for acute and curable cases, in a separate and distinct building. Such separate small hospitals, according to Tuke,† were organized some years ago in some of the Scotch asylums. They may be regarded as the forerunners of the psychopathic hospitals, about which we hear so much at present, and which will be discussed presently.

The objection is often made to large asylums or hospitals that the sight of so many insane persons is depressing and retards cure. But this objection is removed by properly classifying the patients, and keeping the noisy and unsightly ones away from the acute and curable ones.

From both the economic and the therapeutic standpoint it is desirable that the patients should do some work. Savage‡ says that half of the work of the county asylums of England is done by the patients themselves, especially the chronic patients. This is a good thing for both the asylums and the patients. The capacity of these patients for work varies, of course, with the individual, and the experience at Wernersville is said to prove that the amount of work per patient is much less than is to be obtained from the sane. But the plan is not to be measured by a mere utilitarian standard; the welfare of the patient is the prime object.§ Good judgment is required in selecting both the kind and the amount of labor for each patient, for, like the administration of drugs, the administration of work and play is a part of the treatment of the insane. It is needless to say that menial labor should not be prescribed for patients whose social position has placed them above it, for the insane are usually very sensitive to these things.

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* Brush: "Hospital Treatment of Insanity," in Hare's Syst. Pract. Therapeut., vol. iii, p. 173.

† Tuke: Brit. Med. Jour., May 3, 1891.

‡ Savage: "Insanity and Allied Neuroses," pp. 225, 226.

§ "Insanity—Forms and Medico-legal Aspects," Wharton and Stillé, "Med. Jurisprudence," fifth ed., vol. i, p. 673.

Large hospitals or asylums present many advantages in the way of recreation and amusement, as well as useful occupation. Recreation and amusement are a part of the therapeutic scheme of every good asylum. Recreation may be defined as a method in which the patient amuses himself; and amusement, as a scheme in which somebody else amuses the patient. Thus all forms of sports, both indoor and outdoor, such as games and athletics, are modes of recreation; while concerts, lectures, exhibitions, etc., are means of amusement. The distinction is not merely an academic one, for a different mental reaction is secured in these two modes. In the one the patient is active, in the other he is passive. In games, which require the personal coöperation of the patient, more mental exertion is required than in mere amusement, in which the patient is a passive spectator. It is a better sign, as a rule, for an insane patient to engage in games than to sit listlessly at some concert or show. At the same time it is often a mistake to drive insane patients to either the one or the other. The same may be said of reading and sewing. The slightest exertion may be most distasteful to melancholiacs, and it is not good practice to force them to play, to read, or to occupy their minds.

Every hospital for the insane should be equipped with a complete hydrotherapeutic and bathing outfit. The subject of hydrotherapeutics will be discussed in detail presently. In this country some of our hospitals are splendidly equipped in this respect; as, for instance, the McLean Asylum, near Boston, and the Pennsylvania Hospital in Philadelphia, where large swimming-pools, with all modern conveniences, have been built.

A gymnasium is a desirable adjunct to every asylum. Athletic exercises should be prescribed and systematically overlooked and controlled. This is the age of physical culture: the insane can often profit by a proper course of it.

A training-school for nurses is a part of the outfit of most of the larger asylums. It is well for every institution to have an arrangement with some general hospital, by which nurses may be exchanged, so that these attendants may be thoroughly trained, not only in nursing the insane, but also in general nursing. This all-round discipline is most advantageous.*

The patients who especially require treatment in an asylum are the chronic cases; the homicidal and suicidal patients; the excited and violent patients; the profoundly depressed or melancholic and stuporous patients; and the dements. Even in milder acute cases the patients must often of necessity be sent to asylums, because their friends have not the means to secure private treatment for them; and if they are separated from the chronic and violent cases, they can be, and often are, treated most successfully in large asylums.

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* At the Friends' Asylum in Frankford, Philadelphia, the plan has been adopted of having their nurses take a third year in one of the general hospitals of the city. In a personal communication Dr. Chase, of the Friends' Asylum, says that such a plan is also adopted by some of the New England hospitals for the insane.

The system of caring for the insane in colonies has proved successful in some countries. This is also called the family system. In some parts of Germany and France there are colonies attached to hospitals; the insane either live together in a sort of farm colony, or they are boarded out among the country people. The best known of these establishments is that of Gheel, in Belgium, where the insane, according to M. Régis,* to the number of nearly two thousand, are scattered through a country district, with a central infirmary for such patients as need more direct medical care and treatment. Such a system is open to many objections, and while the object of it is to afford country life and employment, and to avoid the evils that come from close confinement in an asylum, it is difficult to see why the same advantages cannot be secured in a well-conducted institution, such as Wernersville. Where patients are boarded out among a rural population they certainly cannot be objects of close observation and care. Gheel had its origin in religious superstition; it is indigenous to the soil of Belgium, and it is doubtful whether it could safely be copied elsewhere.† In England and Scotland, however, there is what is known as the "cottage system," in which the insane are boarded out, somewhat as at Gheel. In Scotland in 1888 it is said that 22.8 per cent. of all the insane were thus farmed out. The object was to rid the asylums of a multitude of mild, inoffensive, chronic lunatics, and to secure family life for this class. The system has also been tried in this country, especially in Massachusetts and Wisconsin.‡

This naturally leads to a discussion of the whole subject of the treatment of the insane outside of the walls of an asylum.

The Extramural Treatment of the Insane.—There is always a sentiment abroad in the community in favor of treating some classes of the insane outside of the asylums. This sentiment is shared both by the medical profession and the laity. The reasons for it are not far to seek.

In the first place, with the advances of psychiatry as a science the fact has become more widely recognized that the insane are merely sick persons. They are no longer looked upon as a class apart, separable from all the human race as something strange, mysterious, terrifying, and even uncanny.§ Moreover, the scientific study of insanity is by no means confined to the asylums; in fact, very great activity in studying mental pathology is shown in clinics and laboratories apart from the hospitals for the insane. As a part of neuropathology, the study of all brain disorders is a common ground now for the neurologists and the alienists. This has been and continues to be a potent means of breaking down the barriers, where such have existed, between the asylums and the outside world.*

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* Régis: Op. cit., pp. 562, 563.

† Lunatics were originally attracted to Gheel by the legend of St. Dymphna, who cured them, of course, by miraculous intervention. When the patients did not recover, they were left on the inhabitants—hence the colony system of Gheel! (Tuke: Dict. Psych. Med., vol. i, p. 547.) For a recent account see "The Colony of the Insane at Gheel," by Dr. M. A. Cleaves, Jour. of Ment. Sci., April, 1891.

‡ Tuke: Dict. Psych. Med., vol. i, pp. 140–143.

§ For the relation of witchcraft to insanity see Lecky, "Rationalism in Europe," chapter on "Magic and Witchcraft"; also Calmeil, "De la Folie," Paris, 1845; and Esquirol, chapter on "Demonomania," in his translated work, Philadelphia, 1845.

In the second place, there is a natural prejudice against the necessity for certifying the patient as insane. It is doubtless a wise and necessary provision of the law that throws every safeguard around the personal liberty of the citizen; hence all modern states have provided an exact system of certification of the insane, by which they are admitted to the asylums.† But this very precaution of the law imposes the painful necessity upon the friends of the patient of having him legally declared a lunatic. This is popularly thought to put a stigma upon the patient and his family—one which will cling to them for all time. However unwise this prejudice may be, it is very strong, and it sometimes acts to keep patients out of the hospitals when they urgently need treatment. It might, indeed, be far better if these restrictions were somewhat relaxed, and insane patients were allowed easier access to the asylums, without a resort to the much dreaded certificate. Valuable time is lost, and incipient cases are converted into confirmed or even chronic cases because friends postpone to the last moment the evil day. It has been found that where access was thus made easier the number of incipient cases—and therefore more hopeful and curable cases—applying for treatment, has been increased.

If the physician and friends decide against internment, there are several plans that are possible. The patient may be treated in a general hospital, or in a private sanitarium, or even in a private residence, or in a psychopathic hospital.

Almost all general hospitals in our large cities supply private rooms for the sick. These may be used for some of the milder cases of mental disease, although it goes without saying that they are only adapted to such milder cases. Patients with neurasthenia, mild melancholia, and the various forms of delirium may thus be treated. Thus delirium tremens and some kinds of toxic insanity are not uncommonly treated in such hospitals. Excited and noisy patients, such as maniacs, or those with suicidal or homicidal impulses, should not be admitted. The authorities of general hospitals are much and properly averse to entertaining such cases, and a single instance of noisy mania, or of suicide, is likely to close the doors against proper and deserving cases. The disadvantages of general hospitals are several. Located as they usually are in thickly built-up parts of great cities, they do not supply facilities for outdoor life; hence they are best adapted to cases in which bed-treatment or strict rest-cure is used. Moreover, some highly nervous and apprehensive patients fear the sights and sounds of a general hospital; the very fact that they are confined in one is disquieting to them. Nevertheless, good results may often be obtained in the kind of cases mentioned.

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* Griesinger said, "Diseases of the nervous system form one inseparable whole, of which the so-called mental diseases only embrace a certain moderate proportion." (Quoted by Tuke, in Brain, May, 1905, p. 1.)

† As far back as the reign of Edward VI (in 1548) it was enacted that "if any person be, or shall be, untruly founden lunatic, idiot, or dead" he shall have a right to traverse the inquisition at his pleasure. (2 and 3, Ed. VI, Chap. 8, Sec. 6.)

The question of nursing may also be an acute one. Nervous and mental cases are not looked upon with favor by the average hospital nurse, but this is a matter of detail and of discipline; if the chief is in earnest, he can soon train both his internes and his nurses. In a recent article Mosher holds that general hospitals should provide for many forms of acute mental disease.* Among the advantages of general hospitals are the clinical and laboratory outfits, and the routine and discipline, as well as the close and constant supervision of the patient. These hospitals are always ready; they always have plenty of nurses and attendants; there are always assistant physicians on duty day and night, and there is the prevalent sense of security and good service that comes from a well-conducted and well-reputed hospital.

The private sanitarium is only a small hospital. It is necessarily more expensive than the larger institutions, but much that is said about these applies also to it. There are many of them in this country, and many insane patients are treated in them. If they are incorporated and licensed, they may require a certificate, just as in the case of the large asylums; but many of them are purely private ventures, and their merits depend entirely on the personality and skill of the individuals who conduct them. A well-managed private sanitarium, however, offers an ideal way to treat some of the insane. Perfect privacy and seclusion are secured; the patient does not need to be certified; laboratory work can usually be done in some neighboring general hospital; nurses and assistants can be trained absolutely to the will of the physician; the atmosphere is entirely devoid of the characteristics of a hospital; and the exact nature of the disease can be concealed from a too curious world. In fact, many mildly insane patients (and some that are not mild) are treated in private under the euphemism of "neurasthenia" or "nervous prostration."

The disadvantages are that noisy and violent cases cannot be controlled; that outdoor life is curtailed, especially in cities; that a serious risk is often run of suicide and even homicide; and that the *tædium vitæ* may become just as acute in protracted cases as in large asylums. From these facts it follows that only certain types of cases should be admitted, such as mild melancholiacs, manic-depressive patients, confusional and delirious cases, cases of the toxic insanities, and of puerperal delirium, if not too restless. In other words, cases with a hopeful prognosis, or a chance of recovery, but no chronic or incurable cases, are the ones for treatment in private sanitariums.

I have had some experience in treating insane patients in private dwellings; that is, away from the patient's home. People of large means sometimes insist on renting a whole house, and practically converting it into a private sanitarium for the one patient. But this is often a bad, or at least unsatisfactory, plan. The morale of such an establishment is likely to become bad; the patient's family are constant intruders, nurses are not properly kept under control; the patient soon becomes a tyrant; and the practitioner assumes a needlessly heavy responsibility. Such a scheme is not much better than treating a patient in his or her own home. Exception, however, may sometimes be made in favor of the dwelling of some responsible caretaker, such as a good trained nurse, for a mild and curable case, provided the patient's family and friends can be kept at a distance.

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* Am. Jour. Insanity, Jan., 1909, p. 499.

Psychiatric Clinics and Psychopathic Hospitals.—In Germany psychiatry is an integral part of medical education, and clinics for mental diseases have been established at many of the universities and hospitals. This marks an advance, which meets with great approval at present in America and even in England. The prime object of these German clinics is education in psychiatry, but such clinics also influence in a very direct way the treatment of the insane. It is stated that there are not less than twenty-two such hospitals or clinics in Germany, the most noteworthy of them being at Munich.* Such clinics should be established, it is claimed, in close proximity to a medical school or university. They should have ample space for bed patients; the Munich hospital is said to contain 110 beds. There is also an amphitheater for students, and various rooms and laboratories for special research of all kinds. The medical staff consists of not less than six resident and two non-resident assistants, under the general direction of a professor of psychiatry. Hydrotherapeutics are given a prominent place, and the work of teaching, of nursing, and of clinical study is elaborated to the highest degree. It is claimed by some enthusiasts that the future of psychiatry depends upon the establishment of such psychiatric clinics; but we are concerned here more particularly with the effect upon the treatment of insanity. Obviously the tendency of such clinics must be toward an early treatment in incipient cases, also a thorough study and handling of such cases, and finally these clinics probably tend to draw acute and peripatetic cases which often go so long without proper study and care.

Hence the establishment of psychopathic hospitals in all our large cities would possibly be a step in advance. It is not necessary, however, that they should always be built in connection with a medical school; in fact, it is desirable that some of them should be quite independent of such clinics. While medical education is essential, the welfare of insane patients is equally so; and not a few of this class in this country would prefer to take their mental troubles elsewhere than to the medical schools.†

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* See a letter by Dr. Paton in Science, Sept., 1905; also an editorial comment in the Boston Med. and Surg. Jour., Sept. 14, 1905, p. 314.

† The Pennsylvania Hospital in Philadelphia was one of the first in this country to establish a clinic for mental cases. Dr. John B. Chapin informs me that a dispensary service for such cases was established by that hospital in November, 1885. It was intended for mild and incipient cases. The number of patients applying has not been large, probably not averaging fifty a year. The fact is worthy of note also that this hos-

The chief advantages of small psychopathic hospitals would be that they could attract and receive patients without legal certification, and treat them as other sick persons are treated. As Sir J. B. Tuke has recently pointed out,* our method of certifying the insane is a legal rather than a medical device, and it often acts to deter patients from being sent to the asylums for treatment. Insanity should be treated in its early stages; by so doing, patients are rescued from prolonged attacks, even incurable or fatal attacks. In Glasgow, according to Tuke, an observation ward for early acute cases was successfully maintained—the only one at that time in Great Britain. Although many of these patients are alcoholic cases (about 28 per cent.), not all of them are so, as some writers have maintained. Such an institution is an intermediary between the insane and the asylums; patients who are found not to be suitable can be transferred to the latter institutions.† In the large Philadelphia Hospital we have for some years had "detention" wards, one for men and one for women, in which acute and uncertain cases are kept for observation and treatment, without certification. These are really "psychopathic" wards.

We must not allow ourselves, however, to be deceived by mere names. A "psychopathic" hospital is, after all, merely a hospital or clinic for the insane. The treatment of the insane should practically be the same in all hospitals; there is not one way of treating typhoid fever in one hospital, and another way in another. The special advantages in psychiatric clinics, as already said, are first for purposes of study and education, and second, for the prompt treatment of incipient, or early, or mild cases.

The Criminal Insane.—It is the uniform opinion of alienists that this class should be treated entirely apart from the non-criminal insane. America has lagged behind England in this respect, but there are signs that we are catching up. The asylum for the criminal insane at Broadmoor in England is the type of institutions which we should have in this country. In Pennsylvania, a few years ago, according to Dr. McLeod, of the State Lunacy Committee, more than 400 insane criminals were scattered among various asylums and jails

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pital, the oldest in the United States (founded in 1751), opened its wards to the insane at the very beginning, and that thousands of such cases were treated by it as a general hospital, before it opened its special insane department in West Philadelphia in 1841.

The "psychopathic" ward in the Albany hospital (called "Pavilion F," in order to avoid a special designation) has been in successful operation for some years under the care of Dr. Mosher. Although cases of ordinary insanity have been treated in that ward, the larger number of cases have been of temporary delirium, some of them due to alcoholism. As this ward is not a legal receptacle for the insane under the State laws, patients cannot be forcibly detained. This "psychopathic" ward at Albany has been the subject of discussion by the British Medico-Psychological Association. (See the proceedings in recent issues of the Journal of Mental Science.)

For recent observations on psychiatric clinics in Germany see papers by Dr. C. K. Clarke and by Dr. E. Ryan in Am. Jour. of Insanity, Oct., 1908, p. 357 and p. 348.

* Tuke: "The Relation of the Lunacy Laws to the Treatment of Insanity," Brain, May, 1905, p. 1.

† For a discussion of this whole subject the reader is referred to Paton's recent work, "Psychiatry," chap. VI, J. B. Lippincott Co., Phila., 1905; also to Peterson: "A Visit to the Newest Psychopathic Hospital," in the Medical News, vol. lxxvi, 1900.

of the commonwealth. Grave questions in criminology and sociology are involved, but this is hardly the place to discuss them.*

Drug Treatment.—The tendency of some practitioners is to overdose their insane patients. This is true especially with respect to the abuse of *sedative medicines*. It is a common saying, in a large and well-known hospital for the insane in Philadelphia, that they do not pretend in that institution to make a scientific diagnosis, much less a prognosis, in new cases until after they have rescued the patients from the poisonous effects of the depressive drugs with which they are usually overloaded when admitted. When called to see cases of insanity, I have not infrequently found them partially stupefied with bromids and other sedatives; sometimes the patients literally smell of the bromids, and have the bromid acne on the skin. This routine treatment is usually a mistake, and an injury to the patient. In no way is the judgment of the practitioner better shown than in the way in which he uses sedative drugs in cases of insanity. It is doubtless true that such drugs are often demanded, but they should be kept under strict control, and never given by mere routine. To give them indiscriminately, and merely to mask troublesome symptoms, is a confession of weakness, or even of ignorance.†

Treatment without the use of sedatives has been given extensive trial, with alleged good results; as, for instance, at Renfrew Asylum in Scotland, where they hold that if more attention were paid to elimination and less to procuring sleep, it would be better for the patients.‡

Opium is the most important sedative drug, and is a valuable remedy in some cases. This is true especially in acute and agitated cases of melancholia.§ The treatment of melancholia with opium was more in vogue formerly than at present; but even yet some leading alienists advocate it in all forms. Schüle called opium the splint of the sick mind. General rules cannot be laid down; much must be left to individual judgment; but there can be no doubt of the beneficial action of this drug in early cases of excited melancholia, or manic-depressive insanity, in which there is great mental suffering, constant unrest, and exhausting insomnia. In such cases it is best to use it in full doses, especially at night, for a period of some days, with the object of giving the patient a much needed rest. Opium acts not only to procure sleep, but also to relieve the mental pain. The object in giving it should be to tide the patient over a critical period; its effects should be carefully watched; no dose should be given except by the express order of the physician; and if it causes evil symptoms, such as nausea, refusal of food, or a bad reaction, it should be discontinued. It is, however, well borne in most of these cases. As soon as it can be well discontinued it should be withdrawn. Used thus, it may be a boon. The best form usually is by morphin under the skin; but some observers prefer the opium itself in some form, such as crude opium or a strong deodorized tincture. The hypodermic use of morphin is less liable to cause derangement of the stomach. Opium or any of its derivatives should not be used in chronic cases, as a rule, unless in senile dementia, in which a moderate use of it is quite justifiable.

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* Consult Tuke, "History of the Insane in the British Isles"; also Nicolson, "Criminal Lunacy in England," in "Allbutt's System of Medicine," vol. ix. p. 438; and Drähm's "The Criminal," 1900.

† Chapin: "Compendium of Insanity," p. 91, et seq.; also W. Maule Smith, "On the Use of Hypnotic Drugs in the Treatment of Insomnia," in the Journal of Mental Science, July, 1905, p. 561, and the succeeding discussion.

‡ Jour. of Ment. Sci., April, 1911, p. 398.

§ For a dissenting opinion see Berkley, "Mental Diseases," p. 128.

In acute delirium and delirium tremens opium may be demanded. It is a question whether in some cases it is not the best drug. In adynamic cases of delirium tremens, however, such as occur in old chronic inebriates, in which there is great debility and perversion of nutrition, opium should not be given in large and overwhelming doses. The same may be said of all depressing medicines.

Hyoscyamus, or its alkaloid, hyoscin or hyoscyamin, is sometimes better borne than opium. It is useful in cases of delirium, and of maniacal excitement.* It is not so sure, however, in its action as opium and its salts, although Wood says that it will sometimes succeed in acute mania when morphin increases the excitement.† In recent years it has been extensively used. Noble‡ says that old people are profoundly affected by moderate doses of hyoscin. He thinks it is just as efficacious by the mouth as hypodermically, and that if the desired effect is not produced by $\frac{1}{60}$ of a grain, it is useless to increase the dose further. Ramadier and Sérieux,§ from a large experience, extol hyoscin in mania and delirium. Belladonna, which acts very similarly to hyoscyamus, is recommended in cases of puerperal and other deliria in which there is a tendency to collapse, with lowered arterial tension and a leaky skin.

Cannabis indica is one of the uncertain drugs of which the pharmacopœia is so full. That it is potent for mischief, however, is evident from the fact that in the East it is used extensively as an intoxicant, and is the prolific cause of toxic insanity in Egypt and India.|| For some reason the drug seems to be of uncertain strength and reliability as found in the shops. It has an unenviable reputation for not doing what is expected of it. In mental diseases it has often been used—more formerly than at present. Reynolds lauded it as a hypnotic in the insomnia of senile dementia, and Clouston found it valuable, when combined with the bromids, in acute mania. The sleep produced by this drug is usually accompanied with dreams. It must not be overlooked that hashish is a delirifacient, and that in moderate doses this action may predominate; in fact, it has been praised in melancholia because it tends to convert the depressed patient into

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* Shaw: Jour. of Nerv. and Ment. Dis., vii, 27; also Ringer: Practitioner, March, 1877.

† Wood: "Therapeutics," eighth ed., p. 241.

‡ Noble: Yale Med. Journal, No. 8, 1900.

§ Ramadier and Sérieux: Bul. Gén. de Therap., Jan., 1892.

|| Peterson: "Medical Notes in Egypt." Dr. Peterson says that of 248 mental patients whom he saw in Cairo, 60 men and 4 or 5 women were insane from the abuse of hashish, or cannabis indica. In India a drink called "ganjah" is used, and is held to cause 53 per cent. of the cases of lunacy in Bengal.

an exalted maniac. Such a virtue will not commend it to the judicious practitioner. It seems that there is nothing legitimate that cannabis indica can do that an opiate cannot do better. Fronmüller, who made extensive observations, found that it succeeded as a hypnotic in only about 50 per cent. of the cases in which it was tried. A large dose is often required, and this may cause an initial delirium, and a subsequent giddiness, headache, and vomiting.

Conium has the physiologic effect of subduing motor excitement by its action on the motor nerves. Ringer says that its action on the cerebrum is less definite. Nevertheless conium acts as a sedative in excited states of the brain accompanied with great motor unrest, as in mania. Spitzka* gives this drug first place as a sedative in such cases. Whether its action is greater on the peripheral or on the cerebral nervous tissue, the fact remains that when the drug subdues the motor excitement, sound sleep is likely to occur.

Cocain by hypodermic injection has been used by Morselli and Buccola in cases of melancholia, and is recommended by Régis,† but cocain is a dangerous drug, and conducive to a most destructive habit.

Next in importance to opium as a sedative is probably *chloral hydrate*. It is a hypnotic, or sleep-producer, rather than an anodyne, hence it would seem to be especially called for in insanity. The objection to it, however, in very excited cases, such as delirium tremens and acute mania, is that larger doses are sometimes required to produce sleep than are altogether safe for the heart. I once saw sudden death occur in a case of delirium tremens in a young man in a large general hospital, probably due to an overdose of chloral. Ringer says that in overdose death threatens at the lungs and heart.‡ Chloral has been used extensively, especially in the asylums.§ All the various excited patients, such as the acute maniacs, the agitated melancholiacs, and the victims of delirium in any form, have been subjected to it. It is claimed to produce a more refreshing sleep than opium, and one which has no bad after-effects. Small, or moderate, repeated doses are better, certainly safer, than heroic doses, and in case the patient does not respond to moderate doses it is better to discontinue the drug. Clouston,|| from a very extensive asylum experience, cautions against overdosing the insane with chloral. He, too, has seen sudden death apparently caused by it. Chloralamid is sometimes used as a mild substitute for chloral.

The *bromids* are an especially important group of sedatives in the armamentarium of the alienist, because of their powerful influence in epilepsy and various forms of epileptic insanity. In other forms of mental disease they are not particularly valuable, although they are of all drugs, perhaps, the ones which are most resorted to and most

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* Spitzka: "Insanity," 1883, p. 384.

† Régis: "Mental Medicine," translated by Bannister, p. 594.

‡ Tuke: Dict. Psych. Med., vol. ii, p. 1134.

§ Bevan Lewis: "Mental Diseases," second ed., p. 475.

|| Clouston: "Mental Dis.," 1884, p. 146.

abused in routine drug-giving by the general practitioner. But in epilepsy they stand preëminent, especially for controlling the fit; although they are also of almost specific value in controlling epileptic delirium and mania. They are often combined with other drugs, such as chloral, cannabis indica, hyoscyamus, etc. As mere hypnotics in ordinary cases of brain excitement, neurasthenia, mania, and insomnia of senility, the bromids are inferior to some other drugs, especially chloral. They are contraindicated in all cases of confusional and stuporous insanity, for, as Seglas says, they tend to augment these psychoses.*

Paraldehyd is a hypnotic and has been used quite extensively by alienists. Some years ago it was tried in many cases in the Philadelphia Hospital. I am not aware that it has maintained its popularity, although it has been highly commended by some alienists, notably Clouston and Krafft-Ebing. It has a disagreeable taste and imparts an unpleasant odor to the breath of the patient, and these are not slight objections. It belongs to the alcohol group, and is deleterious if used in large doses by routine. Krafft-Ebing has noted a paraldehyd habit.†

Among recent hypnotics may be mentioned *sulphonal*, *trional*, and *veronal*. They are mild remedies in the doses usually employed, and from this very fact they are not likely to do much harm. In all cases of brain excitement and insomnia, as in mild mania, agitated melancholia, neurasthenia, senile dementia, etc., they may be tried, and will sometimes be found useful, especially when the more potent drugs, such as opium and chloral, are not desirable. In very excited patients, however, these hypnotics are often disappointing. Sulphonal has been used in very large doses by the British alienists, but their opinions of its value differ.‡ I consider veronal the best of the group. It is a more potent drug than the others, and alarming symptoms have been reported from its use in large doses.

Methylene-blue has been used in insanity. Bodoin extols its action as a sedative in cases of great mental excitement. It proved satisfactory in cases of mania, delirium, alcoholism, and hystero-epilepsy. When injected into the gluteal muscles, in doses of 1 to 1½ grains, it exerted a quieting influence within a few hours, and this lasted from one to four days.§ But its action is not constant, and its peculiar discoloration of the lips, tongue, saliva, and urine may have a bad effect on the patient's mind, exciting the suspicion of being poisoned, as Rapporte has pointed out.||

Scopolamin hydrobromate is a recent remedy which has been found

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* Seglas: "Les Maladies Mentales," 1895, p. 208.

† Krafft-Ebing: "Traité Clinique de Psychiatrie," traduit par Laurent, p. 239; see also Behr: "Beitrag zur Kasuistik der Paraldehyddilerien," St. Petersbg. med. Woch., 1902, Nr. 14.

‡ Journal of Mental Science, July, 1905, p. 561.

§ Bodoin: Klin.-therap. Woch., Nov. 21, 1899.

|| Rapporte: Rev. (Russe) de Psych., de Neurol. et de Psych. Experiment., 1904, No. ii, p. 857.

efficacious in mania and delirium in doses of $\frac{1}{400}$ to $\frac{1}{100}$ of a grain.* It requires to be given with care. I have had no experience with it.

Before dismissing the subject of sedative drugs, I may say of the whole group of them that they are at best only necessary evils. It is always better to do without them if possible, and the practitioner should carefully avoid the temptation to use them by routine on any and all occasions. Much may be done without sedatives, if a resort be had to fresh air, hydrotherapeutics, and proper hygiene; and by avoiding the habitual use of them we avoid the risk of adding drug intoxication to the insanity of our patients. Let us remember the story of Hippocrates: he used hellebore, which from a very high antiquity has enjoyed a reputation as a specific in insanity; but he compelled his patients to go and gather it for themselves at Anticyra, thus obtaining for them exercise and diversion.

Stimulation is sometimes demanded in cases of insanity, but just as in the case of sedatives, so in the case of alcohol, caution is called for. In cases in which there is exhaustion and a lowered general vitality, wines, whisky, or beer, in moderate doses may be indicated. Thus in delirium, with prostration, a moderate amount of whisky is sometimes beneficial.

In cases of delirium tremens, however, opinions differ about the use of alcohol. I have usually treated such patients without alcohol, and I always prefer to do so. It does not seem reasonable, when treating a case of toxic insanity, to continue to give the poison which has caused the disease. Repeated doses of hot milk are better in most cases than milk-punches. This is true especially of young and naturally robust patients; but in old and broken-down inebriates we may be driven to use alcohol, upon which the system has so long depended. Even in such cases, however, the stimulant can usually be rapidly diminished in quantity, and it should be withdrawn just as soon as possible. Ergot is lauded by some writers to relieve congestion and edema of the brain in severe cases.

In a recent paper Régis makes a strong argument against the use of alcohol in delirium tremens, based upon an extensive experience with 84 cases. Alcohol was denied in all, and only 3 deaths occurred, and these could not justly be ascribed to the treatment. The patients were treated with food at brief intervals, frequent purgation, diuretics, plenty of water by the mouth, and 30 to 45 grains of chloral and bromid of potassium per diem. This is the so-called eliminative treatment, based on the view that delirium tremens is an autotoxic psychosis, in which the liver and kidneys especially are at fault.†

In the profound depression of melancholia a mild stimulation is often beneficial, but care should be exercised not to overstimulate, for the reaction from alcohol, such as the headache and lassitude, is highly injurious to such patients. In acute mania alcohol, as a rule, is not indicated, unless there is danger of physical collapse; the brain excitement is a contraindication, and, in fact, an ordinary case of mania can be converted into one of acute fury by an injudicious use of alcohol.* A prominent alienist† has written that alcohol is unnecessary in most cases of mental disease; but exceptions certainly occur, as he himself has not failed to point out.

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* Bumke: Monatssch. f. Psych. u. Neurol., xiii, 1.

† Régis: Jour. de Méd. de Bordeaux, July 26, 1908.

Tonic and reconstructive drugs are of far more importance in the therapeutics of insanity than are either sedatives or stimulants. The prime object of the alienist should be to build up. Insanity is a physical disease and can be approached successfully, as a rule, only from the physical side; the only exception to this rule is in favor of suggestive therapeutics, which approaches the subject from the purely mental side. But the physical, or reconstructive, treatment of insanity is the one that can never be ignored.

There is no specific for mental diseases—unless, indeed, it be in cases of syphilis—and the only reliable and possible plan in the vast majority of cases is to attempt to build up the physical health. Even in cases of syphilis the treatment is no exception to this rule, for antisyphilitic treatment is directed fundamentally to the physical disorder. But to describe the ordinary tonic drugs is merely to traverse a familiar field, for all practitioners know the use of tonic drugs. The most valuable agents are strychnin, quinin, iron, arsenic, the phosphates, and the bitter tonics. Their uses will be indicated here very briefly.

Strychnin is a favorite remedy with neurologists, more so perhaps than with alienists. It is merely a whipper-up of a jaded or depressed nervous system. Whether it in any way promotes the nutrition of the neurones, may be questioned. It is an excitomotor, having a special action on the spinal motor nerve-centers, but its action on the brain cells is not marked; in fact, such action is even doubtful. In strychnin-poisoning consciousness is not involved, or only secondarily, due to the asphyxia.‡ In ordinary therapeutic doses, even carried to the extent of causing hyper-excitability of the motor system, the brain is not affected. It is therefore difficult to see how strychnin can act to much advantage in cases of insanity. In cases of mania, in which there is already great motor unrest, its use is contraindicated. Bannister§ recommends it in insanity for its general tonic effect, but says it should not be used in large doses. In small doses it probably acts merely as a stomachic. It follows from the nature of its action that it is indicated in cases in which there is depression and malnutrition. Among such conditions are delirium tremens, and various forms of confusional and stuporous insanity. Savage|| uses nux vomica in cases of hypochondriasis, especially with purgatives.

Of *quinin* not much need be said in this connection. It is a tonic in some unexplained way when given in moderate doses—at least,

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* Spitzka: "Insanity," 1883, p. 270.

† Bevan Lewis: "Mental Diseases," second ed., p. 470.

‡ Wood: "Therapeutics," eighth ed., pp. 260–261.

§ Bannister: "Hare's Syst. Pract. Therapeutics," vol. iii, p. 215.

|| Savage: "Insanity and Allied Neurosis," p. 144.

such is its reputation. As a mere tonic it should never be used in heroic doses, so as to cause the characteristic tinnitus—a subjective symptom which might make an injurious mental impression in some patients, especially in hallucinatory insanity. The association of insanity with malaria is not often seen in this country, so the antimalarial or specific action of quinin is seldom indicated in cases of mental disease, unless the malaria exists unmistakably as a cause or complication. If such infection is suspected, it should be demonstrated by a blood examination for the plasmodium, and should then be treated accordingly. Lemoine and Chaumier* have made a complete study of paludal or malarial insanity. Chronic cases are sometimes resistant to quinin.†

Blood-making tonics, such as iron and arsenic, are of great value in some forms of insanity. When discussing etiology, I referred to infections and other blood states as causes of mental disease; with such infections may be associated an anemia. There is then a reduction of the red blood-cells, or of the hemoglobin, or of both. This suggests the importance of careful studies of the blood in insanity—a subject which is probably too much neglected in some of our asylums. In fact, all means for exact clinical study should be used, but in the blood states especially there may be found indications for treatment. Thus in delirious patients, and especially in cases of puerperal insanity, a depleted state of the blood is sometimes found. In a series of observations made by me some years ago in puerperal cases, the blood-count was sometimes observed as low as 3,750,000, and the hemoglobin was also reduced.‡ Hirst observed the case of a primipara impregnated two months before marriage, who developed hemichorea, with great mental weakness or fatuity; the hemoglobin was down to 40 per cent. and the red cells sank to 2,800,000. Among other causes which weaken the blood and conduce at the same time to insanity are chlorosis, onanism, gout, rheumatism, pellagra,§ malaria, syphilis, and the various infectious fevers. Finally, in states of general neurasthenia, mania, and melancholia agitata, in which no blood infection can be made out, there may be some degree of anemia. For all such conditions iron and arsenic are the drugs. They may be given separately or in various combinations. Of iron preparations alone, the best are probably Blaud's pills and Basham's mixture.

The hypophosphates, which usually contain iron, and the bitter tonics and mineral acids, which act principally as stomachics, may be given as reconstructive drugs. Cod-liver oil is probably too much ignored in cases of insanity; it is a food as well as a tonic.

Close attention should be paid to the *gastro-intestinal tract* in insane patients. The condition of the bowels is even more important in some cases than the condition of the stomach; in fact, if the bowels are kept in proper condition the stomach will often take care of itself. A free use, and a routine use, of laxative medicine is often required. As these patients usually require large quantities of food in order to recover, the bowels should never be permitted to become constipated. In melancholic and weak-minded or demented patients the bowels are often permitted by the patient to remain overloaded.

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* Lemoine and Chaumier: "Annales Medico-psychologiques," 1887.

† Régis: "Mental Medicine," p. 378.

‡ Article on "Puerperal Insanity," in Hirst's "Am. Syst. of Obstetrics," vol. ii, p. 579.

§ See Baillarger, Annales Méd. Psychologiques, 1888, for an account of pellagrous pseudo-paresis. Pellagrous insanity is due to a blood dyscrasia caused by eating diseased maize. It is common in parts of Italy and France.

The theory has been advanced lately that some forms of insanity, such as melancholia, hypochondriasis, etc., are caused by an auto-infection which has its primary seat in the stomach or intestine. The idea is that a process of bacterial putrefaction goes on in the stomach and bowel, that the toxins are absorbed into the blood, and a depressed or poisoned state of the system results. Bouchard and other French alienists are especially responsible for some of these opinions. They claim that gastro-intestinal affections are common in melancholia; among such affections are atonic dyspepsia, dilatation of the stomach, fermentation of undigested food, torpid bowels, and perverted secretions. All this makes up a grave indictment, and while some of it may be still unproved, there is a possibility of truth in it too.* Whatever the theory may be, experience amply teaches that in melancholia a free action of the bowels every day is demanded.

When *dilatation of the stomach* has been found, good results have been claimed from washing out that organ. Régis, since 1880, has advocated lavage of the stomach for the relief of sitiophobia, or refusal of food by the insane.† He recommends it also in melancholia, which he believes is often caused by this auto-infection; he claims that a careful chemical analysis of the gastric contents should be made in order to determine the fluid to be employed; and he gives a list of formulæ of antiseptics to be used in gastric lavage in the insane.

Among the best *laxatives* is the old-fashioned pill of aloes and iron; or a pill of podophyllin and colocynth; or one containing rhubarb and blue mass. The various salines are often of great value, and cascara is used not a little.

Saline infusions have been used in order to "wash out the blood" in cases of the toxemia. The physiologic or normal salt solution (0.7 per cent.) is the formula usually employed. The injection is given under the skin of the breast or abdomen, with strict antiseptic precautions. This remedy seems to have been employed especially in Germany,‡ and has also been recommended in this country and Great Britain. Ferguson Watson withdraws 10 c.c. of blood from the median basilic vein and injects 20 c.c. of normal salt solution.* This is all in accord with the eliminative treatment of insanity, *i. e.*, action on the bowels, liver, kidneys, and blood. Large quantities of drinking-water are used, also rectal injections of normal salt solution.†

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* Bettencourt Rodriguez, International Congress of Mental Medicine, 1889. See also the thesis of Chardon on "The Influence of Infectious Diseases on the Development of Mental Disorders," Lille, 1889–90; also thesis of Feyal, Lyons, 1890, and the writings of Régis, "Médecine Mentale." Cf. Chapter on "Melancholia" in Wharton and Stillé's "Med. Jurisprudence," vol. i, p. 632, fifth ed.

† Régis: "Mental Medicine," translated by Bannister, p. 595.

‡ Wiçkel: Psych.-Neurolog. Woch., 1903, 18. Kraepelin: "Lectures on Clinical Psychiatry," translated by Johnstone, 1904, p. 121.

Alteratives.—In cases of *syphilitic infection* of the brain, causing syphilitic dementia in any of its various forms, whether with or without local palsies or involvement of the spinal cord, it is imperative to begin anti-syphilitic treatment at once. Even in doubtful cases the treatment, if properly controlled, will do no harm; therefore every patient with doubtful symptoms should have the benefit of the doubt.‡ The Wassermann test should be used in these cases.

The combined treatment, *i. e.*, with both the *iodids* and *mercury*, is probably best, especially in very acute cases, or in cases in which the infection as well as the symptoms are recent. In very late cases of cerebrospinal syphilis the iodids are thought by some observers to be better; but even in late cases it is wiser to try mercury also. The distinctions, so much insisted on by academic writers, between "secondary" and "tertiary" symptoms are vain. In the face of such a grave infection it is enough to know that we are confronted by a poison which is attacking vital tissue. A much more grave question is to determine the form of mercury to be used and the best method of using it.

Within recent years a prejudice has arisen among neurologists against giving mercury by the mouth for any form of cerebrospinal syphilis. The chief objection is the loss of time. It is often impossible thus to bring the system under the influence of the drug with sufficient rapidity and effect to save tissue. Indeed, some competent observers say they never obtain the same results by the mouth as by inunction. Therefore it is wisest in every case to give this drug either by inunction or hypodermically. We thus obtain a more rapid and thorough result, and we avoid gastro-intestinal irritation, for when mercury is given by the mouth the larger part of it probably passes off by the bowel.

If inunction is practised, a small piece of blue ointment, or, better, a small quantity of the oleate of mercury or of the oleum cinereum, can be rubbed into the skin of the inside of the thighs. This may be repeated daily or two or three times a week, the effect being watched.

The hypodermic use of mercury was much advocated a few years ago; and it is still practised. In such a grave affection as brain syphilis it is well to try it. White§ says it should be used when other methods have failed; or when gastric and other idiosyncrasies prevent the internal use; or, most important of all, when grave and rapidly progressing lesions demand prompt action. This last indication is sufficient to demand a trial of this method at once in some cases of brain syphilis.

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* Watson, Ferguson: Jour. of Ment. Science, April, 1911, p. 398.

† Archdale: Jour. of Ment. Science, July, 1909, p. 458.

‡ See the writer's article on the treatment of diseases of the spinal cord in Wilson's "American Text-Book of Applied Therapeutics," p. 1027, from which some of the statements in the text are borrowed.

§ White: "The Treatment of Syphilis," in Morrow's "Syst. of Genito-urinary Diseases," vol. ii.

Both the soluble and insoluble salts may be given under the skin. Corrosive sublimate may be used in doses of gr. $\frac{1}{12}$ to $\frac{1}{4}$ every day or every two or three days. A method much lauded is that of Cruyl and Burlureaux, quoted by White. The sublimate is mixed with oil as follows: the mercuric salt is first dissolved in ether; the solution is then added to the oil, and the ether driven off with heat. Large doses of the sublimate are thus given, as much as one or even two grains. It is claimed that acute syphilis can thus be "cured" with five or six doses, but this probably does not refer to such lesions as meningo-encephalitis.

Calomel has been used in emulsion by hypodermic medication. The emulsion may be made with glycerin, mucilage of acacia, or vaselin. Jullien claimed great benefit from the precocious treatment of syphilis by this method. I have practised it in a few cases of syphilis of the spinal cord. The injection is usually made deeply into the buttock, under strict antiseptic precautions. It is painful and may be followed by an indurated swelling, and even abscess. When calomel is thus injected a deposit of the drug probably remains for a long while in the tissue, and absorption takes place slowly from this deposit; hence there is a potent and long-continued action. Destructive salivation has occurred, making it necessary to excise the deposit from the tissue, and Jullien says that in dogs he has found traces of the drug *in loco* as long as eighteen months after the injection. The drug thus used has been found especially efficacious in syphilitic disease of the eye and in syphilomata. Its use in brain syphilis has not been so extensive.

I am disposed now in most cases to rely upon the inunction rather than the hypodermic use of mercury. The arguments *pro* and *con* may be read in White and Wood's chapter, *ante*, vol. ii, p. 475.

Baccelli* has practised intravenous injections of *corrosive sublimate* in two cases of cerebral syphilis. The injection was given in a vein at the elbow, on the back of the hand, or on the leg. There was absence of pain, or of subcutaneous swelling. The metallic taste of the drug was noticed by one patient in a few seconds, and a flow of saliva followed. Baccelli claimed as an advantage the prompt action of the drug on the walls of the blood-vessels, which are the favorite seats of the poison.† I have never resorted to this method, and therefore cannot recommend it.

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* Baccelli: Berlin. klin. Woch., 1894, No. 13, p. 301; abstracted in the Am. Jour. of Med. Sci., July, 1894, p. 88.

† See the report of the meeting of the French Society of Dermatology and Syphilography at Lyons, 1894, for a full discussion of the hypodermic use of mercury. According to Jullien, in some cases, in spite of the administration of mercurial pills, not a trace of mercury is found in the urine, because apparently the metal passes through the bowel without being absorbed. Mercury appears in the urine two hours after a hypodermic injection, while in cases in which it is absorbed it does not appear for six days after ingestion, and for one week after inunction.

The common fault in the administration of the *iodids* is that they are given in too small doses. The dose should be run up rapidly to 30 grains, and even 40 or 50 grains, three times a day. Syphilitic patients usually bear these large doses well. The sodium salt is probably preferable to the potassium salt, as it is not so irritating to the stomach and kidneys.

General paresis is usually not in the least controlled by anti-syphilitic treatment, although this treatment is probably used at some stage of the disease in most cases in a vain hope. The treatment should not be pushed, for it may do harm to these patients, whose resistance to drugs is much impaired. Some observers, however, claim that anti-syphilitic treatment will sometimes control acute symptoms, and even establish a remission.*

I regard it as still too soon to give final judgment on the potency of Ehrlich's new arsenical preparation, known as "*606*," or salvarsan. Favorable, but premature, reports have already appeared in the literature. So far as general paresis is concerned, it is impossible to see how any drug can ever effect a cure in the advanced stages when vital tissue has been hopelessly destroyed. In 27 cases of tabes and paresis W. Pick† did not observe any convincing effect, but in a case of cerebral syphilis the remedy proved efficacious. Treupel‡ claims that he noted favorable modifications in early incipient paresis. Schlesinger thinks the remedy ought not to be tried in grave cases of paresis, and believes that the classic medication by the mercurials and iodids is the most important means at hand. Marinesco§ had negative results in six cases of paresis.

Oppenheim|| thinks that salvarsan is not more efficacious than mercury and the iodids. It appears to be efficacious in gummatous processes, but does not influence arteritis. He thinks also that we must guard against its noxious effects, and should forewarn the patient, and let him assume the responsibility—a thing which is evidently not practicable in a case of general paresis. But in this disease, he says, we ought not to expect any important effect from the remedy.

Favorable reports in cases of cerebral syphilis have been made by Wechselmann, Jadassohn, Treupel, and others; but in general paresis Milian and A. Pick report unfavorably. The literature has become too extensive to be reviewed here.**

Some bad effects have been observed from the action of this arsenical drug, especially on the optic nerves and some other cranial nerves. It seems certain that in advanced and broken-down subjects it is capable of doing injury.

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* Chapin, in Wilson's "Am. Text-Book of Applied Therapeutics," p. 1184; also Krafft-Ebing: "Traité Clinique de Psychiatrie," traduit par Laurent, p. 689.

† Pick, W.: Wien. klin. Woch., No. 33, 1910.

‡ Treupel: Deutsche med. Woch., No. 39, 1910.

§ Marinesco: Presse Médicale, No. 102, 1910.

|| Oppenheim: Deutsche med. Woch., No. 49, 1910.

** A digest of the recent literature was read by Dr. F. X. Dercum at a meeting of the Philadelphia Psychiatrical Society and to this digest I am indebted in preparing the statements in the text.

Some observers have held out the hope of an anti-serum or antitoxin for general paresis, based on the alleged finding of a *bacillus paralyticans* as the cause of the disease.*

Among alteratives or specifics may be mentioned *thyroid extract*, which has been given on the theory that hypothyroidism, or deficient secretion of the thyroid gland, is a cause of mental disease. The whole subject is still in a very theoretical stage. In cretinism and myxedema there is undoubtedly seen a grave mental affection. So, too, in exophthalmic goiter, in which there is supposed to be a hypersecretion of the gland, various psychoses are observed; and dementia præcox isclaimed by some observers to be associated with a goitrous change, but in such cases thyroid extract would, on theory, be contraindicated.†

The Rest Treatment.—Too much cannot be said in praise of the rest treatment for certain forms of insanity. The day has gone by for broken-down nervous patients to be simply dosed with medicines, or to be actively exercised in the open air, or hurried about the country for "change of scene." These patients are sick; their nutrition is often below par; they exhaust more rapidly than they build up; and their bodily resources need to be husbanded to the utmost extent. The insane patients who especially demand rest treatment are the acute melancholiacs, the confusional and delirious cases, the cases of toxic infection, the grave neurasthenics, and in fact all patients whose physical condition is one of malnutrition, exhaustion, and anemia.

When the rest treatment is practised it should be given systematically and thoroughly. The patient, for a while at least, should be kept absolutely in bed, and secluded from all visitors. Competent nurses are most essential. Persistent feeding, the use of tonics and mild stimulants, and careful attention to the gastro-intestinal tract, are demanded. Hydrotherapeutics, massage, and passive movements, should take the place largely of sedative drugs. After a while, when improvement begins, the patient may be allowed to sit up for a stated period each day, and even removed into the open air and sunshine, but not to exercise. Details must be left to the judgment of the practitioner; there is not space in these pages to go into minutiæ. But the general rule may be set down, that nutrition is to be the guide. It is well to have blood-counts made, and the weight regularly taken. As the patient improves, the monotony may be broken by reading or, in the case of women, some light sewing or fancywork, if agreeable to the patient.‡

Outdoor Treatment.—Since the invention of the outdoor treatment of tuberculosis, there is seen a tendency to try something like it for the insane. An incentive was given by A. E. Macdonald, who, however, tried it more particularly for the tuberculous insane. It was found to act beneficially on the mental symptoms in these cases, and from this was but a step to trying it for non-tuberculous patients. It is quite compatible with bed-treatment, for the patients who are taking rest-cure can be moved out of doors, and made to live in tents or on verandas. There is much in the suggestion that is attractive. The mental impression is, of course, one of the main things that tell in such treatment; it is a form of suggestive therapeutics, but a most wholesome form. The stimulating and bracing effect of the open air, the sky above, the environment of green things in summer, and the sunshine and sense of unrestraint all the year round—all these are likely to have a salutary effect on the mind. It has even been found that this treatment is beneficial in cases of dementia and for uncleanly patients, and Haviland and Carlisle have practised tent-life successfully for this class.* But even in the acute psychoses, such as melancholia, neurasthenia, and mild forms of confusional and manic-depressive insanity, there is no reason why systematic outdoor life or tent-life, even combined with rest treatment, should not prove practicable and beneficial. In the more chronic cases, in which bed treatment may not be advisable, a life in the open air for as many hours a day as possible is often indicated. This need not be associated, of course, with excessive exercise. Clouston† says that some patients cannot have too much fresh air, though they may have too much walking, or gymnastics, or muscular fatigue.

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* O'Brien: Am. Jour. Insanity, July, 1908.

† Packard: Am. Jour. Insanity, lxvi, 189; Berkley: Am. Jour. Insanity, 1909; Werelius and Rydin: Jour. Am. Med. Assoc., Aug. 5, 1911, p. 449.

‡ The subject of bed treatment in insanity was discussed in the Section of Psychiatry of the Thirteenth International Congress of Medicine, in Paris. See an epitome in the Brit. Med. Journal, Sept. 22, 1900. See also S. Weir Mitchell: "Diseases of the Nervous System, especially in Women," Phila., 1885; Dercum, in "A System of Physiologic Therapeutics," edited by Cohen, vol. viii, Phila., 1903.

In addition to the mental impression, the physical effects of outdoor life are most beneficial. The patients will eat more, digest better, and sleep more soundly.

Amusements.—According to an old Greek fable, Melampus cured the insane Prœtides with the use of music, dancing, and hellebore. David played upon his harp to soothe the distracted mind of King Saul. In well-regulated hospitals the monotony of asylum life is often broken by various kinds of amusement. In the extra-mural treatment of the insane, amusements cannot well be so systematically and largely employed, but it is often necessary to try some forms of recreation. A useful accomplishment in a trained nurse is to be a good reader, but she should never be allowed to bore her patient with her readings. This subject of amusements is one of the details which must be left to the judgment and opportunities of the physician. It has already been discussed in these pages (page 1004). Various kinds of indoor and outdoor games are in order, such as playing-cards, chess, checkers, backgammon, dominos, billiards, croquet, tennis, cricket, and baseball.

Rush‡ reminds us that music has long had a reputation as a remedy for insanity, and that history records two cures of royal patients by it; he also tells of a learned doctor who was cured by the study of mathematics, and of a lady whose mind was successfully diverted by playing cards.* But Griesinger† approves the sentiment of Guislain, who declared himself against those promiscuous dancing parties sometimes given in English—and, we may add, also in American—asylums. Lectures, concerts, and exhibitions of various kinds are perhaps better.

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* Haviland and Carlisle: "Tent Life for the Insane," in Am. Jour. of Insanity, July, 1905, p. 95.

† Clouston: "Mental Diseases," 1884, p. 117.

‡ Rush: "Medical Inquiries and Observations upon the Diseases of the Mind," Phila., 1830, pp. 203 and 209.

Systematic instruction or education may be included under the head of recreation, for thus it acts in some cases of insanity. It is perhaps best suited to educated persons. As in the case of the learned man who turned to mathematics to relieve his mental stress, so in other cases the mind may gradually be induced to take up some old or long-neglected study, as the classics, English, French or German literature, music, or modeling, painting, and drawing. This method is only adapted to certain kinds of patients, and the physician must be the judge.

Gardening and the care of domestic animals and pets often act well. Sewing and fancy work for women, and periodical literature for both sexes, are invaluable. Mention may also be made of drives and short excursions to places of interest.

Mechanical Restraint.—Since Pinel struck off the shackles of the insane at the Bicêtre, and William Tuke inaugurated his reform at the York Retreat, this subject of mechanical restraint has gone through several phases.‡ It is not necessary here to follow the history of the subject; it is sufficient to say that after a century of discussion and trial, opinion has settled down to a moderate course, upon which most alienists are fairly well agreed. Sentimentalism has about run its course, and experience is now allowed to have its legitimate sway. We have not lived to see the day, so fondly predicted, when all means of restraint have for once and forever been banished to the garret; instead we live at a time when a rational reaction has established itself against "Conollyism," and when restraint is recognized as a proper and necessary procedure in some cases.§ But, as Hack Tuke has written, it is only against the fanaticism which makes a fetish of non-restraint that we ought to protest.|| In England the Legislature has passed an act which recognizes restraint, and lays down regulations in regard to it. In America there are probably no lunacy boards which do not recognize the necessity of occasional restraint.

Following Hack Tuke, we may say in brief that the patients who require mechanical restraint are those who are subject to violent impulses to suicide, or to self-mutilation, or to persistent self-abuse, or surgical patients who interfere with the dressings, or patients who

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* For an interesting discussion on the healing influence of music see two chapters in "Primitive Psycho-therapy and Quackery," by Robert Means Lawrence, M.D., 1910.

† Griesinger: "Mental Pathology and Therapeutics," 1882, p. 347.

‡ Tuke: "History of the Insane in the British Isles."

§ The system of "Conollyism" derives its name from Dr. John Conolly, who was an extremist on the subject of non-restraint, and practised it on every and all occasions at Hanwell Asylum.

|| Dictionary of Psychological Medicine, vol. ii, p. 1318.

are extremely dangerous to others, or finally those whose violent and ceaseless agitation tends to fatal exhaustion.

There can be no question that proper means of mechanical restraint are less irritating to insane patients than being forcibly held by a lot of attendants. Less violence is done by a camisole, or a stout sheet fastened across the patient as he lies in bed, than by the efforts of strong attendants forcibly to hold and coerce him. There is much less risk of accidents, such as bruises, strains, and fractures. There is not the personal element, the constant combat, the anger and resistance, in the one way as in the other. Hence an excited patient will more promptly yield to mechanical than to personal control.

The means used to restrain a violent patient should be at once efficacious and as little injurious as possible. In delirium tremens a stout sheet pinned across the patient as he lies in bed, with properly padded cuffs and anklets to restrain the limbs, is often all that is necessary. In cases of violent mania, a camisole, restraining the hands, may be used. Chains and irons are, of course, not to be tolerated. A padded room is sometimes a necessity in order to prevent the maniac from injuring himself. Seclusion is an important part of restraint; the patient should see no one but the necessary attendants, and he should be carefully watched and guarded night and day.

Mechanical restraint should not be used until all other means have failed. Among such means are a proper system of baths, sedative medicines, and the co-operation of a sufficient number of watchful attendants. We shall speak more of baths when we discuss the subject of hydrotherapeutics.*

Among the follies to which the doctrine of non-restraint has led is the so-called "open-door treatment," according to which there are to be no locks and keys even, and the insane are to be allowed to come and go as they please; a plan which has been justly ridiculed by Mercier.† At the other extreme we may place the "protective" bed, which is made like a cage, in which the unfortunate patient is kept like a rabbit or a squirrel.‡

Diet and Feeding.—This is a large subject, in one sense, and a very simple one, in another. If I should attempt to go into full details, it would be easy to spread the subject over many pages; but there is neither space nor necessity here for great elaboration.

The cardinal rule in feeding the insane, especially the acute cases, is to put a sufficient quantity of light, highly nutritious, and easily digestible food into the stomach. In order to accomplish this feat it is necessary to have a nurse who thoroughly understands this part of

* Paton, in his recent admirable work, "Psychiatry," p. 149, says, "In institutions which are not properly equipped for the carrying out of hydrotherapy mechanical restraint often becomes a necessity." To this it may be said that hydrotherapy, valuable as it is, cannot entirely take the place of mechanical restraint in any institution, whatever its bathing facilities may be. There is no such necessary antagonism between the two methods—mechanical restraint and hydrotherapy—as is implied in the passage quoted.

† Mercier: Jour. of Mental Sci., July, 1905, p. 573.

‡ See illustration of such a bed in the Jour. of Mental Sci., July, 1909, p. 559.

her business. It is not enough to prepare the food and bring it on a tray to the patient's side; it must be gotten into the stomach. Herein lies one of the secrets of good nursing.

The preparation of the food, however, is no mean part of nursing. A good hospital should have a good sick-diet kitchen—it is not a good hospital without one. If this is established, and a competent cook and nurse in charge of it, the physician can properly feel that much of his responsibility in the case is lightened.

Broken-down nervous and insane patients can take an astonishing quantity of food, if it is skilfully administered. Clouston, in his inimitable book (which is worth more in this respect than all the dry, didactic treatises), tells us constantly of his triumphs with milk and eggs. Milk is so universally used that it surely needs no encomiums; but it is possible to give too much of it; and if it is given at the rate of several quarts a day, the physician should not be surprised if his patient has no appetite for other food. The objection to milk is that it leaves a large residuum in the bowel, which tends to constipation. A good way to give milk is in the form of koumys; or diluted with an effervescing carbonated water.

Buttermilk, either natural or artificially prepared, in which a large amount of lactic acid is present, is often a useful article of diet. Natural buttermilk contains less fat than the artificial product. I need not stop here to discuss the theories that the bacteria and the lactic acid in these various kinds of sour milk act as bactericides in the intestinal tract. Whether or not this is the correct explanation of their special value as foods, it is a fact that they are sometimes acceptable and valuable additions to the diet of the insane. They should not be used, however, to too great excess, as there is a tendency at present to do, for they thus interfere with the taking of other kinds of food. To some patients they are very distasteful, and in this case they should not be forced on the insane. My preference is for the artificial form of buttermilk; it is of a better taste than buttermilk from the dairy and is not so likely to be contaminated; it is also richer in cream; which, however, may or may not be an advantage.

Predigested milk is advised by some authorities, especially for very weak stomachs. It is distasteful to many, and in my experience has few if any advantages over good pure milk for the great majority of patients. It is even a question whether it may not be harmful sometimes by interfering with the natural digestion.

I can see but little indication for the use either of skimmed milk or of whey. The latter is only of use in very desperate cases, in which the stomach rejects stronger food, but such cases are very rare.

Too much cannot be said in favor of eggs as a diet in these acute cases. An egg is one of nature's best products; its sole function is to nourish. The average weight of an egg is about 60 grams—13 grams of which are of useful substances—albumins and fats, especially a phosphorized fat. Hence one egg has the nutritive value of about 150 grams of cow's milk, or of 50 grams of meat; that is to say, ten eggs equal one pound of beef. Moreover, the intestinal digestion of eggs leaves little to be desired. Ninety-seven per cent. of the albumins and 95 per cent. of the fats are absorbed, therefore little residue is left.* For administration to the sick, eggs should never be overcooked; in fact, the nearer raw, the better. They can be beaten up raw, flavored with lemon or orange juice and a little sugar, or a little wine, and given two at a time. If cooked, they should not be boiled, but steamed; that is, the eggs in the shell are dropped into hot water, not kept boiling, and allowed to remain about three minutes. Thus prepared they are lighter, and more like a delicate custard, than when boiled or poached; and as many as six, eight, or even ten can be given in a day. The aversion which some patients have to eggs on the score of producing "biliousness" is largely imaginary, and can be easily overcome. Custards made of milk and eggs are also valuable. Egg-albumin water, prepared by mixing the raw white of egg with iced water, and flavoring with lemon, is excellent for a weak digestion.

The various meat broths are only valuable as adjuncts; their nutritive value is not high, and they should not be allowed to take the place of milk and eggs.

A well-selected miscellaneous diet of light meats, vegetables, and fruits is often, of course, demanded. Monotony in diet should be avoided with most of these cases. But the diet of the insane should be carefully supervised in large hospitals; these patients should not be allowed to choose for themselves at a large general table. An insane patient in a hospital in Philadelphia once developed scurvy, although she went regularly to a well-supplied table. It was found that she persistently avoided vegetables.

Patients with delusions of poisoning require great care in feeding; they will sometimes almost starve themselves. One patient, known to the writer, would eat willingly only a few boiled eggs, because she believed that they could not be tampered with.

On the other hand, some insane patients, especially dements, eat ravenously, and of the most unwholesome articles. Such a patient in the Philadelphia Hospital nearly choked to death on a large piece of gristle.

In cases in which a large quantity of food is needed, great care should be taken of the stomach and bowels. Laxative medicine is needed at frequent intervals, as has been explained on a preceding page. Bitter tonics, mineral acids, pepsin, and a little alcoholic beverage, are often indicated.

Most patients will eat better when they have plenty of fresh air, as already explained. Even in cases taking the rest-cure, this demand may be met; the patient can be moved out of doors for several hours each day.

Very weak patients require some nourishment early in the morning on first waking. They suffer from the long fast of the night. This is so especially of melancholiacs, who are often at their worst in the morning. A glass of warm milk is useful, even before the breakfast is ready. It may even promote an additional morning nap.

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* The Dietetic and Hygienic Gazette, Oct., 1905, p. 598.

Coffee or tea need not be denied to all patients for breakfast. If the patient is accustomed to one or the other of these, it should be given, but not later in the day. These drinks are slightly stimulating to the brain.

Mercier has said that the best sleep-producer is a full belly.* A little light nourishment at bedtime may be better than a hypnotic.

In anemic cases an occasional blood-count should be made in order to note progress, and in all cases the patient should be weighed at stated intervals.

Special diets, based upon theory, as the salt-free diet in epilepsy, are usually found in the end to be of little value.†

Forcible feeding is required in some cases of insanity. But just as in the matter of mechanical restraint, so on this question of forcible feeding, opinions among alienists have differed. Some extremists have even claimed that it is never necessary to force food into an insane patient's stomach; but the majority recognize the necessity and resort to the practice in troublesome cases. The arguments pro and con cannot be set down here in detail.‡

The causes for the refusal of food are numerous. Anorexia, stupor, obstinacy, the desire to die, and, above all, delusions, are the chief causes. The mental state should be studied carefully, with the view of overcoming the obstacle. By consulting the patient's idiosyncrasies, and even by humoring him in various ways, or by skilful persuasion, we may often get him to take food. Persistent appeals, with great patience and plenty of time, will sometimes succeed. Spoon-feeding is better than forcible feeding, if it will only succeed. Some patients will take one kind of food and not another; or will take food from one attendant only; or at certain times, or under special circumstances. Some will take it if left to themselves and not watched. In fact, the freaks of insane patients in this respect are innumerable.

But there are unquestionably some patients who will not take food under any circumstances; their refusal is so absolute that if left to themselves they will fail rapidly. In such cases the only common-sense thing and the only humane thing to do is to feed by force.

Many precautions are necessary if food is to be forced upon a patient. The risks of injury are not slight. Even overpersuasion has its risks. I had a patient recently in a private dwelling who bit a piece out of the edge of a tumbler while two nurses were trying to persuade her to take liquid food; there was great fear lest she had swallowed some fragments of glass. The moral is that a glass vessel should not be used.

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* Mercier: Jour. of Ment. Sci., July, 1905, p. 573.

† Dorner: Abstract in Jour. of Ment. Sci., July, 1910, p. 533.

‡ See Sutherland's full discussion in his article on "Feeding" in Tuke's Dictionary of Psychological Medicine, vol. i, p. 494.

Forcible feeding may be done with a rubber tube, passed either by the mouth or by the nose. Some patients submit readily, even assisting in passing the tube. If they resist, a sufficient force of attendants, as many as four or six, is required to secure the person. This should be done carefully before the attempt is made to pass the tube, and every precaution must be observed to avoid injuring the patient. A mouth-gag may have to be used. When all is ready, the tube usually passes easily down the esophagus, but care is to be observed that it does not enter the larynx. As a rule, forcible feeding should only be done under the personal supervision of a medical attendant.

The food to be used must consist necessarily of liquids or semi-liquids. Milk, eggs, custards, strong broths, are the essentials.

Clouston tells of a patient who was fed with the stomach-tube no less than 8300 times during eleven years.* This illustrates better than words the necessity and the practice in some of these very troublesome cases; also the fact that feeding with the tube may become a mere habit.

Kraepelin recommends auscultation of the stomach to make sure that the fluid enters that organ, for the tube may be recurved in the esophagus or pharynx, with disastrous results. Krafft-Ebing approves this plan.†

Régis calls these patients "sitiophobes," and says that esophageal catheterization should never be practised on them by the mouth, because of the special difficulties, but always by the nose.‡ Among the risks of forcible feeding is inhalation pneumonia, caused by the passage of minute particles of food into the bronchioles.

Hydrotherapeutics.—It is not too much to say that hydrotherapeutics is now very much in fashion in the treatment of the insane. Perhaps there is some risk of claiming too much for this method, and of raising false hopes. Nevertheless, hydrotherapeutics, in spite of the inordinate claims of its friends, is a valuable adjunct to treatment.

This is by no means a new subject. Indeed, it is as old as the time of Hippocrates, who used baths in the treatment of the insane. In bygone days baths and douches were much abused; they were resorted to like the strait-jacket in order to subdue the maniacs.§ Currie in 1796 cured maniacal patients by throwing them "headlong into the cold bath." The cold douche was used to scare insane patients out of their delusions, or to unmask the malingerer, or to induce the noisy lunatic to keep quiet. When things went wrong, and the patient grew obstreperous, the hose was turned on him.‖ This was a form of punishment rather than of therapeutics, and its advocates must now be few in number, and mostly limited to the keepers of jails.

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* Clouston: Jour. of Ment. Sci., July, 1875, p. 310.

† Krafft-Ebing: Lehrbuch; also "Traité Clinique de Psychiatrie," par Laurent, p. 328.

‡ Régis: "Mental Medicine," translated by Bannister, p. 597.

§ Tuke: Dictionary, vol. ii, p. 1292; also vol. i, pp. 119, 120.

‖ MacDonald: "Feigned Insanity, Homicide, Suicide, Case of William Barr," in Am. Jour. of Insanity, vol. xxxv, p. 411.

So-called *baths of surprise*, such as buckets suspended on pivots, which suddenly tilted over and deluged the unhappy patient, were once in vogue. Some of the devices read like the inventions of the Inquisition; thus, in Germany, they shaved the patient's head, and poured buckets of water on him from a height, or allowed it to drop on him drop by drop. Guislain in France fastened the patient in a tub with a cover over it, through a hole in which the victim's head protruded, on which water was squirted from a pipe several feet away. Van Helmont submerged the patient almost to the point of drowning him—a practice justly condemned by Esquirol.* These are instances of the extravagances and abuses to which the "water-cure" has led; and although they are not likely to be repeated, it is just as well to be on guard against the school of alienists who seem about to cure all forms of insanity with hydrotherapeutics.

The most useful baths are the alternate hot and cold, the prolonged warm, the hot or the cold pack, the shower, the douche, and the swimming-pool. The Turkish and Russian baths are also most valuable, but require a special plant. In not a few asylums, however, elaborate bathing establishments are now built, and almost any kind of fancy bath can be furnished. The special effect of some of these fancy baths is largely by suggestion.

The *alternate hot and cold bath*, or the hot bath followed rapidly by the cold, is useful in some cases. In neurasthenia, especially in men, such a bath may be given daily, preferably in the morning, followed by brisk massage. In weakly or delicate patients, especially women, the cold bath is not well borne, but when well borne it is tonic. It should not be given unless followed by a strong reaction and sense of glow or warmth.

The *prolonged or continuous warm bath* has been used since the time of Pinel. It is much in favor at the present time for excited or maniacal patients. It may be given for a long time; in fact, Falret and others in France used to continue it for hours at a time. The temperature of the water may be at 90° to 100° F., and some alienists have even used a temperature as high as 120°, but this is a dubious expedient. The prolonged warm bath is soothing, and will sometimes take the place of sedative drugs. If too long-continued it may be debilitating; hence its effects should be carefully watched.

Hinsdale in his recent book† gives a long list of the American asylums in which systematic treatment with baths has been instituted. This list proves the favor with which this method is now regarded. I am more familiar with the practice of the Philadelphia Hospital, where eight continuous baths were established in 1907. The patients treated in this way include cases of acute, chronic, and recurrent mania; excited types of dementia præcox; maniacal episodes of epilepsy; alcoholic insanity and the insanity of chorea. The former chief physician, W. W. Hawke, reported great improvement in some of these cases. The prolonged bath was continued in some of them for several days, the temperature ranging from 95° to as high as 105° F. At this hospital we have also hot-air and vapor baths.

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* Esquirol: "Des Maladies Mentales," Paris, 1838, Tom. ii, p. 215.

† Hinsdale: "Hydrotherapy," 1910, p. 168.

The *hot or warm pack* is also useful as a sedative, especially given at bedtime. The patient is wrapped in a sheet, wrung out of warm water, and is allowed to remain in it for one half to one hour. It also may take the place of drugs, and it promotes elimination.

The *cold pack* is for more robust patients, and only in case they react. It is then roborant or tonic.

The *shower-bath,* and various douches, in which water is thrown upon the person, are also tonic, and are only indicated in patients who react well.

The *swimming-pool* is an excellent adjunct to every asylum. Its uses are obvious. It promotes cleanliness and is tonic and exhilarating, and is much enjoyed by many of the insane. It is also a means of exercise and diversion.

The *Turkish and Russian baths* have a powerful action on the system, promoting even an alterative action on the skin. They are not only adapted to patients of good physique, but are also used by broken-down folk of all kinds. In ancient Rome the more the population degenerated, the more magnificent became the public baths, like those of Caracalla and Diocletian.

I do not attempt here to enter upon a discussion of the physiologic action of the various baths. Their use is, in a sense, empirical, but none the less valuable if properly controlled and directed. They should have a prominent place in the therapeutics of insanity, and their indications, as already said, are to act, first, as tonics and roborants; second, as calmatives; third, as alteratives and eliminants; and, finally, as means of cleanliness, exercise, and diversion.

Alter has given an account of the comparative results obtained by baths and by sedative drugs.* The evidence is largely in favor of the prolonged warm bath taking the place of sedatives, especially in mania. Paton calls attention to the need of a plentiful supply of nurses for this practice—a need which unfortunately operates against it in many of our hospitals.† Stearns properly cautions against the use of prolonged baths at very high temperatures, as used by the French physicians.‡ Sankey recommends the Turkish bath in some cases of melancholia.§

Massage and Exercise.—Massage is much used as routine treatment nowadays, especially in America, where it is something of a fad. As supplementary to bathing and the rest-cure it is undoubtedly useful. It requires, however, to be given with judgment. Insane patients are different from other patients. Their mental states must be more considered. To some insane persons massage is disagreeable, even irritating. Given just before bedtime it is sometimes exciting and does not promote sleep; but, on the other hand, with some persons it is quite soporific. The kind of rubbing and the duration are details to be determined in the individual case. In cases in which the bed-treatment is used massage, with bathing, takes the place of exercise; but it may also be associated with passive exercise; the two go together.* The Swedish movements may be used. Massage promotes the peripheral circulation. Finally, it has value as a part of suggestive therapeutics—a value which perhaps is not slight. We know that it has been a favorite remedy with charlatans; but, as Weir Mitchell says, that is no reason why they should be allowed to monopolize it.

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* Alter: Centralblt. f. Nervenheilk. u. Psych., 1902, März, N. F., Bd. xv, xxv, Jahrgang.

† Paton: "Psychiatry," 1905, p. 152.

‡ Stearns: "Mental Diseases," 1893, p. 198.

§ Sankey: "Mental Disease," 1884, p. 142.

Bannister says that massage is of benefit in depressed mental states, but that it may do harm in excited, or demented, or delusional patients.† It is remarkable how little mention of massage is made in our American and English text-books on insanity; and Clouston says, somewhat too sweepingly, that massage is the most irrational treatment ever conceived by the medical mind.‡ In this opinion he is not to be followed without due reserve. Régis, who recommends massage in moderate terms, says it is little used in mental cases in France; but Paton, who possibly reflects German opinion, is outspoken in its praise. Frictions, or massage, were used by the ancient Greeks in the treatment of insanity.§

Electricity, especially faradism, goes well with massage as a means of passive exercise.

Exercise in the open air, gymnastics, and athletic sports have a legitimate place in the therapeutics of insanity, but the tendency in the present day is perhaps to overdo them. The insane should not be over-exercised. I have commended outdoor life elsewhere in these pages.

Suggestion.—I might almost say that all wise treatment of insanity should have a suggestive bearing. It should convey to the patient's mind the suggestion of cure. This should never be overlooked. We are treating not inanimate matter, but the human mind. We have an invaluable avenue of approach to the sick brain; that is, the mental approach. Among the ancient Greeks insanity was treated with the aid of religious ceremonies and purifications; in the gospel of St. Mark we have the story of an epileptic cured by the casting out of a demon||; and all through the ancient world the mystic rites of religion were associated with phenomena of hypnotism and mental suggestibility.** The same is true to some extent in our modern world,

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* Von Bechterew: "Heilgymnastiche Behandlung im Bade," Centralblt. f. Nervenheilk. u. Psych., März 15, 1904.

† Bannister: "The Medical Treatment of Insanity" in Hare's Syst. of Practical Therapeutics, vol. iii, p. 217.

‡ Clouston: "Mental Diseases," 1884, p. 63.

§ Tuke: Dictionary, pp. 14 and 15.

|| St. Mark ix : 14–29. There is no probability, of course, that the boy was cured. We are not informed how long he went before the next fit.

** Regnier: "Hypnotism et Croyances Anciennes," Paris, 1891. For light on the epidemic insanity, witchcraft, etc., of the Middle Ages, consult Calmail, "De la Folie," Paris, 1845.

for faith cures abound, and such shrines as Lourdes and St. Anne de Beaupre exercise a powerful suggestive therapeusis on the receptive minds of the devout. The moral need not be lost upon the most rigid scientist, even though he makes no appeal to the supernatural.

Hence it follows that the personality of the physician is an important factor. He should be born, not made. Personal contact with the insane is a drain on any man's resources; yet the alienist should not be of a phlegmatic temperament, merely in order to stand it. The hard, mechanical man, the mere routinist or administrator, is not best adapted to this work. The alienist should be a mind-reader in the best sense; a sympathetic and diligent student; and, above all, a man who understands human nature, and can improvise for himself the best methods of suggestive therapeutics. If he has not the tact and wit to learn these secrets for himself, he can never learn them out of a book.

Nevertheless, we must recognize the fact that of all nervous patients the insane, as a class, are the least open to suggestion. They are too self-centered; too deeply absorbed in their own mental processes, too much distraught, to be easily influenced by persons or things from without. They lack the power of attention. This is true, for instance, of profound melancholia; the patient is as one incased in a shell; to break through this obstacle is well-nigh impossible. In mania the mental faculties are too greatly dissociated, too incoherent; while in delusional insanity, the patient's mind is too much monopolized by his insane ideas to lend a ready ear to the outside voice.

Thus it is that hypnotism is usually a failure in insanity. Proverbially, the insane cannot be hypnotized. I have had success in a very few cases of hysterical and of weak-minded patients, but not with well-marked cases of the psychoses or of paranoia. Krafft-Ebing,* who gave some attention to this subject, and whose opinion is practically the same as that just stated, says that the most promising cases for hypnotism are those of moral insanity, and of the neuropsychoses, such as hysteria, hypochondria, and neurasthenia; patients with obsessions; and toxic cases, such as the victims of alcoholism, cocainism, and morphinism.†

By mental treatment is not intended mere meddlesomeness and obtrusiveness. Nothing can be worse than to attempt to reason with an insane man about his mental state; to argue him out of his delusions. This is the so-called "moral treatment" of Leuret, better called an immoral treatment. The patients were even intimidated and derided. All that should be attempted is to divert the patient, to gain his confidence, to reassure him, and gradually to win an influence over him that may help to lead him back to health.

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* Krafft-Ebing: Lehrbuch; also "Traité Clinique," traduit par Laurant, p. 333; also Von Krafft, Wien, klin. Woch., 1891, No. 43 (with bibliography).

† Wetterstrand: "Hypnotism," 1897; Bernheim: "De la Suggestion," Paris, 1880; Régis: "Mental Medicine," pp. 574–576 (with references); Tuke: "Psychotherapeutics," 1900; Janet: "Etat Mental des Hysteriques," Paris, 1892; Anglade, in the "Traité de Pathologie Mentale," edited by Ballet, Paris, 1903, p. 1347; Lloyd: "A Note on Hypnotism in the Insane," in Philada. Hosp. Reports, vol. i, 1890; Kraepelin: Lectures, translated by Johnstone, pp. 248, 258.

Socrates said to a melancholiac, who complained that he derived little benefit from his travels: "I am not surprised; do you not travel with yourself?" This was a shrewd observation, for the insane are always and everywhere preoccupied with themselves.*

Much is heard to-day of *psychotherapy* based upon Freud's method of psycho-analysis, which is based upon his theory of "repressed emotions." According to Freud, whose ideas are not easily grasped by the average reader, the psycho-neuroses, especially hysteria and neurasthenia, are caused by "repressed" or forgotten sexual emotions. These "repressions" are so completely forgotten by the patient that they only exist in his subconscious life, where they continue to act as disturbing factors, in the nature of fixed ideas, and thus, in a manner unrecognized by the patient, cause the various symptoms of his disease. Psychotherapy consists in a process of "analyzing" these repressed emotions, or drawing them out by a process of catechizing or cross-examining the patient, until he himself comes to recognize the vicious nexus of ideas in his own subconscious life. This recognition acts in itself as a cure—a sort of mental "catharsis." The patient throws out the "perilous stuff" which he has been unconsciously harboring in his mind, and is well!

This process of psycho-analysis requires much time, tact, and patience on the part of the practitioner; whole days indeed being given to a single case. The literature of the subject is already becoming so abundant that the man who attempts to read it has little time for anything else.†

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* Esquirol: "Das Maladies Mentales," Paris, 1838, Tom. 1, p. 139.

† Freud: "Three Contributions to the Sexual Theory," translated by Brill; also "Selected Papers on Hysteria and other Psycho-neuroses," translated by Brill. "Psychotherapeutics: A Symposium," by Prince and others.

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